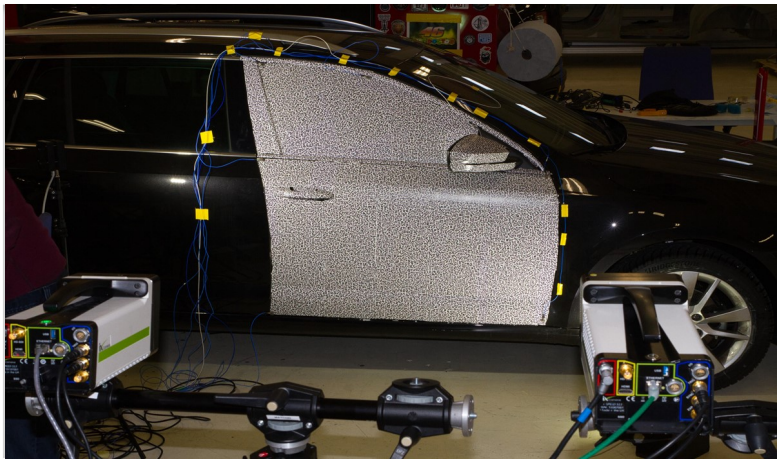
MatchID
Metrology beyond colors

Application

Vibration Analysis: High-speed stereo DIC on car door slamming

Case Description

Two procedures were adopted to introduce vibrations on a car door: via a shaker and through a manual human slam. Both events are imaged with 2 iX high–speed cameras. 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, combining results from classical sensors and DIC.



Experimental Setup

- ✓ **Cameras:** 2 x i-SPEED 513. 6382FPS @ 1920x1080
- ✓ 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

Why MatchID

- ✓ 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

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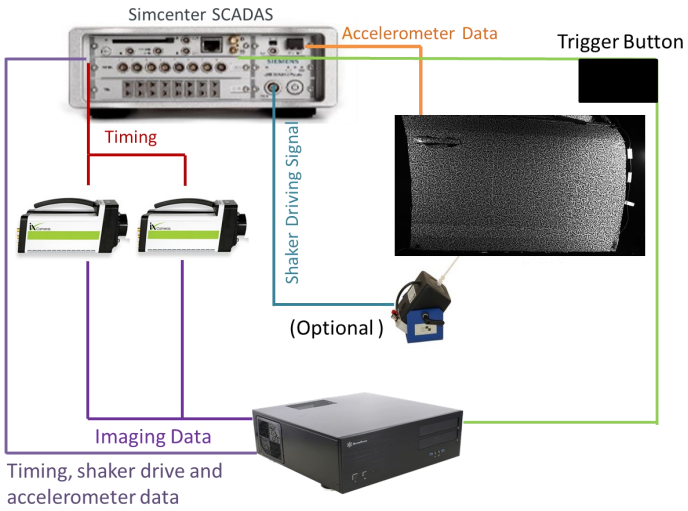
Image Acquisition

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.

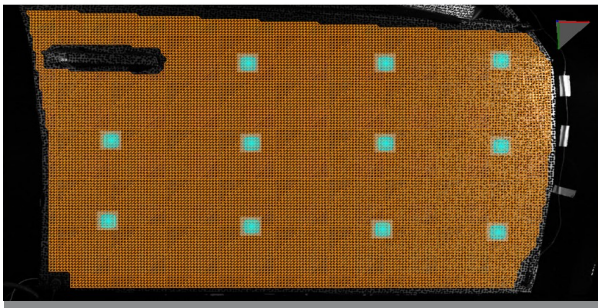
The iX cameras yield a very low noise floor enabling the displacement measurements with DIC even at high frequencies.



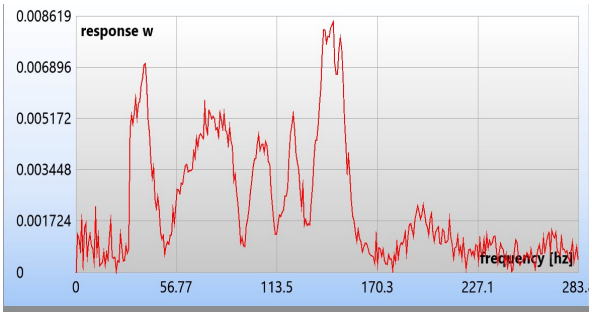
Usage of iX 513 High-Speed cameras for DIC measurements

Mode Shape Frequency Detection

A clear advantage of DIC is that it simultaneously yields the time history of many data channels as the car 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.



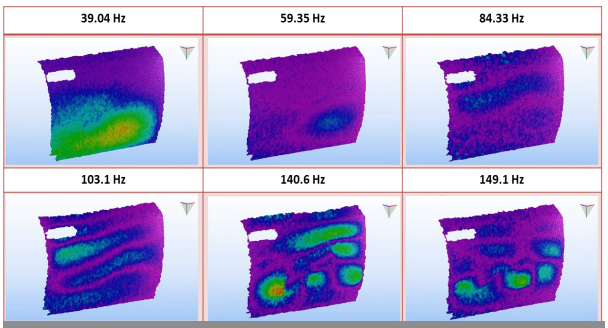
The MatchID software flexibly allows to analyze discrete data points from a full-field point cloud



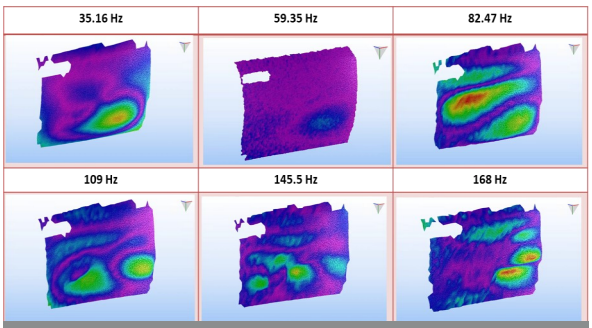
Extracted Frequency response spectrum for a single data channel .

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. Sine-sweep excitation with a shaker and slamming the door results in similar peak frequencies and mode shapes. The mode shapes also clearly reveal the support bars of the door. A clear advantage of DIC is that no pre-knowledge is required on where to analyze the data since it yields many data channels at once.



ODS resulting from vibrations introduced via a shaker



ODS resulting from human car door slamming