MatchID
Metrology beyond colors

July 2020

Newsletter 2020/2

In times of COVID ...

… one gets reminded of the first days of developing a product when a name has to be elected. Next to MatchID (Matching, Characterization and Identification) also COVID (Correlation, Validation and Identification) was on the table. Fortunately we made the right choice.

Weird times often provide opportunities. First, all MatchID team members operational from home, full concentration was on product and application development during the past few months. Witnesses of this fruitful period are our further enhanced trigger box, its solutions towards vibration measurements and our 2020.2 software release. More details on these innovating features can be found further on.

Secondly, it allows to take a step back and more profoundly observe the needs of a young company. The main conclusion of this exercise was space limitation, hampering our daily operations. In this aspect, we found a brand-new spot in the heart of Ghent, including two large test laboratories and the capacity to flexibly seat a substantial amount of employees.

A first of these company reinforcements is Ashikesh Dhanu, our new software architect who will help improve our software products. Welcome to the team! We are not complete though, so if you have a profile fitting our internationally operating R&D company, do no hesitate to send us a CV.

Thirdly, we already had a virtual tradition via our webinar series; we have now intensified these events to stay more closely connected to our community. Feel free to join! In that aspect, last month, for the first time we took part in an online conference, ESAFORM 2020, that was extremely well reorganized at very short notice. Their adopted platform might be a good idea for future conference organizations.

Finally, it allowed us to go back to the cradle of our company, and put effort in a joined accepted publication on our FEA-validation strategy. More details can be found in *Strain 2020, https://doi.org/10.1111/str.12350*

Via this way we wish all our customers, relations and competitor colleagues a good health. We hope to see you all back in person in the near future!

-The MatchID Team

Our brand-new office incorporates well-equipped testing facilities and allows a substantial employee growth on the short term. This emphasizes our expansion ambitions.

In This Issue

MatchID 2020.2

What's new?

MatchID 2020.2 is out now! The newest release offers a cornucopia of novel features, including amongst others:

Integrated Wiki

Fully integrated documentation operational in offline mode providing a plethora of tutorials and theory instructions/ details.

Calibration

A considerably faster and more accurate full-bundle approach for camera calibration in stereo and multicamera mode.

FEDEF module

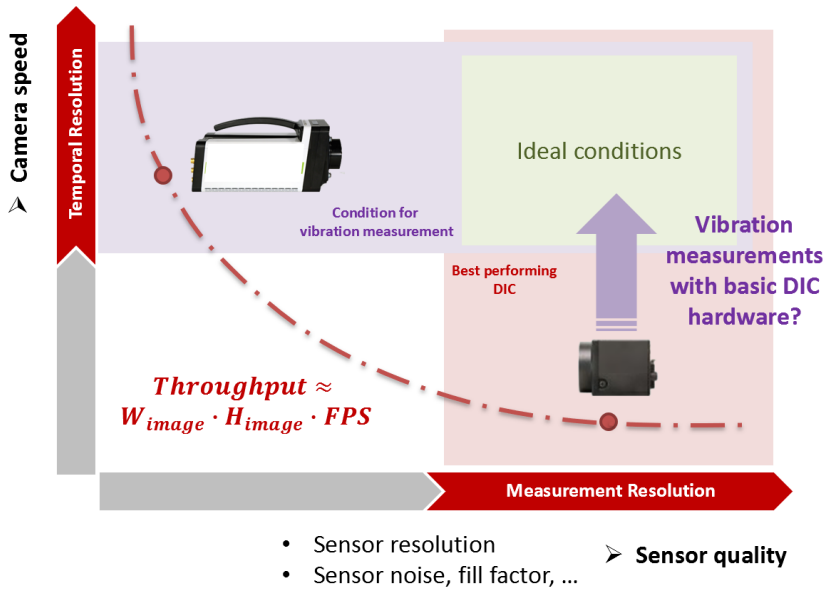
Full redesign with much faster image deformation processing and more intuitive alignment procedures.

Vibration module

Reconstructs a response signal from a steady-state excitation. This allows to analyze high frequency tests via quasi-static cameras operating in the few Hz range.

Image Grabber

Camera and analog breakout functionalities enabling an unlimited number of cameras to be connected and a maximum of 16 analog in channels.



In optical methods, usually a trade-off between temporal and spatial resolution has to be made. Via our vibration module we can circumvent this concession and artificially upgrade low-speed cameras to operate in the kHz range.

Vibration measurements with basic hardware

A key preamble towards a successful DIC experiment is making an appropriate selection of camera equipment. High-speed events as e.g. impact and vibration tests require a substantial temporal resolution which is usually achieved with high-speed cameras. Sensor spatial resolution is generally lower hampering the adequate measurement of displacements with small amplitudes. Alternatively, quasi-static events do not suffer from this limitation and can fully be probed with higher measurement resolution and more optimal sensor quality.

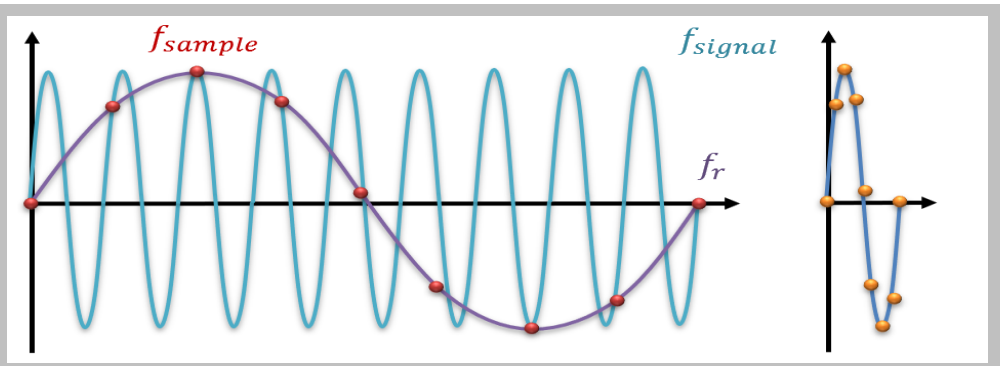
Via our vibration module, **we succeed to combine the best of both worlds** and upgrade the applicability of low-speed cameras to operate in the kHz range in the advent of **a periodic signal.**

How does it work?

When a signal is periodic (fixed sine, chirp, …) it can be reconstructed at a lower frequency using signal subsampling. Consecutively looping over the same signal with a dedicated offset image trigger allows a phase-locking strategy. To this purpose, the camera sample frequency must be carefully chosen and should be in sync with the imposed signal. These requirements are automatically handled via the MatchID trigger box.

What are the benefits?

- High spatial resolution (> 5 MP) operating in the kHz range
- Lower noise floor allows to **measure displacements with small amplitudes**
- Without introducing an excessive cost, an **unlimited amount of cameras** can be invoked enabling **full 3D structural observation**
- Images are **continuously buffered** with no restrictions on recording time



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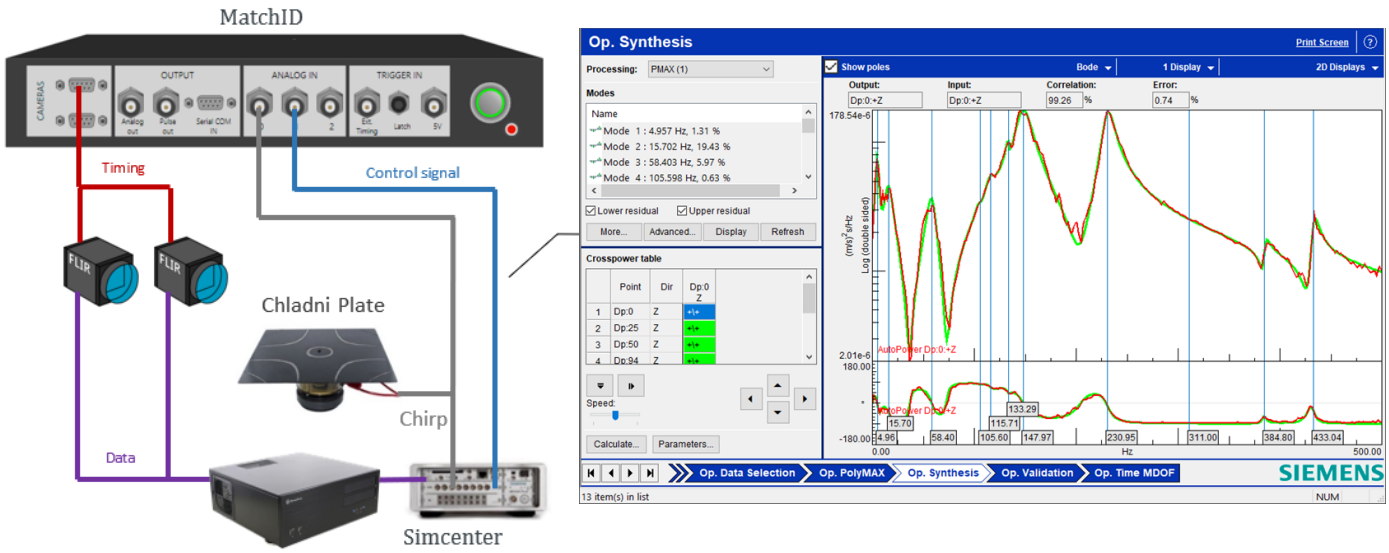


Modal analysis of a vibrating plate with low-speed cameras, our trigger box and Siemens Polymax modal decomposition software.

Application in the picture: Modal analysis of a vibrating plate

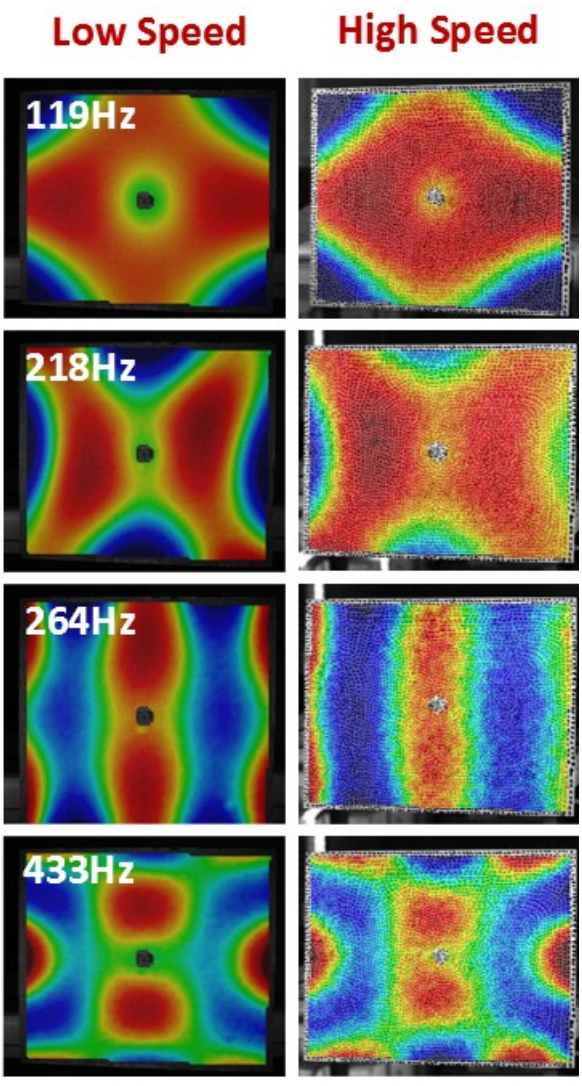
To validate the usage of basic DIC hardware for vibration measurements, the famous Chladni test was performed in our laboratory. Traditionally, by vibrating a metal plate over a certain frequency range one can visually observe the mode shapes of the plate via a light weight powder, e.g. salt, revealing the nodal lines of the structure.

In this study, an anodized aluminum plate (327 x 273 x 1 mm) is equipped with an optimized DIC speckle pattern and is vibrated for only 1 second with a controlled signal of varying frequency ranging from 100 to 750 Hz, a so-called chirp signal, via a modal shaker. Accordingly, in order to respect Nyquist theorem, an image sampling of 1500 Hz should be achieved. First, **two high-speed cameras** with a resolution of 1 MP operating at 1500 Hz were used to record the deflection of the plate. Within the DIC analysis of the high-speed images, a subset of 21 is adopted corresponding to an 8 mm physical area on the plate and generating **a DIC noise floor of 11.6 µm**.

Simultaneously, a **low-speed camera alternative** was set-up, capable to operate up to 75 Hz, though yielding a resolution of 5 MP. Imposing a periodic excitation approach combined with a synced triggering procedure allows for a full response reconstruction. This requires adequate image timing and sorting which is automatically handled in the MatchID Stereo software. For the DIC analysis of the low-speed images, a physical area of 8 mm allows to adopt a larger subset size of 53 pixels, generating a much lower **noise floor of 3.8 µm.**

"Low-speed cameras not only reproduce results of their high-speed siblings, they also deliver a considerable improved signal to noise performance"

Next, for both image sets, out-of-plane displacements are imported into **Siemens Polymax** to identify the eigenfrequencies. Finally, the corresponding operational deflection shapes (ODS) were determined. These are illustrated in the attached figure. As can be seen, both low-speed and high-speed cameras predict very similar ODS, **confirming the capacity of adopting basic DIC hardware at higher frequencies**. Moreover, a considerable improved signal to noise performance is achieved.



ODS at various frequencies recorded with low speed and high speed cameras.

Horizon 2020 RFCS project VFORM-xSteels:

MatchID originates from a university environment and still has a substantial focus on research involvement. In this view, we are happy to announce our commitment to a recently approved European project entitled

"Toward virtual forming and design: Thermomechanical characterization of advanced high strength steels through full-field measurements and a single designed test "

and involving partners as Universidade de Aveiro, Universite de Bretagne Sud, KU Leuven, Universita Politecnica delle Marche, OCAS and DAF Trucks. This project will allow us to take a giant leap in our virtual fields module and material identification strategy.

… Do you have a project in mind where MatchID would fit in or where we can be of any help? Let us know! We are always ready to brainstorm or share ideas.

A novel software architect!

Ashikesh Dhanu acquired a MSc Embedded Instrumentation and Control at ESIGELEC, France.

He is the novel software architect at MatchID, with a primary focus on extending our AppStore to a broader spectrum of engineering solutions.

We welcome him warmly to the MatchID community!

… And we are looking for more people. Please send us your CV!

A new distributor for North-America!

We are very proud to announce a new distributor of our products for the North-American market:

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Our collaboration has its cradle within the framework of several Flemish-funded R&D projects resulting in **a unique knowledge symbiosis** with well-recognized experts of structural dynamics and optical measurement applications.

… If you have questions related to our products and solutions, do not hesitate to consult them for professional advice.

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