MatchID
Metrology beyond colors

Application Note

Real-time signal feedback for communication with a test bench

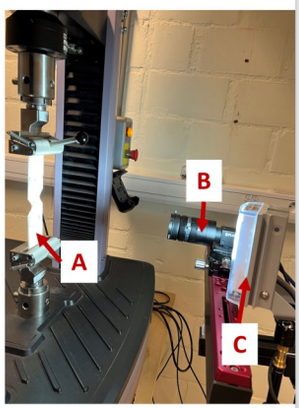
Case Description

Aim: Demonstrate the real-time (RT) feedback capabilities in the MatchID Grabber.

Approach: A 2D-DIC experiment was set up. A uni-axial tensile test was performed on a high density polyethylene (HDPE) test sample with two notches. A DIC *extensometer* was used to ***live-track*** the longitudinal engineering strain in the central part of the sample as shown in the adjacent figure. The RT-feedback feature in the MatchID Grabber and the MatchID feedback unit were used to plug in the engineering strain as an analog voltage to the test bench.

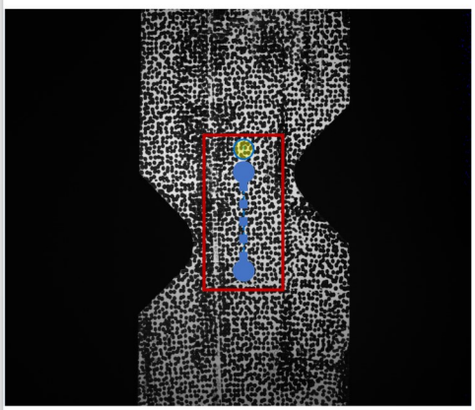
Outcome: As programmed, the tensile test was successfully stopped when the engineering strain feedback signal reached the preset threshold of 1%.

Test setup



A – Test sample
B – Camera
C – LED light

Test sample



1D extensometer
- **Measured quantity – engineering strain**
- **Length = 22 mm**
- **Angle = 90° (longitudinal)**

Experimental Setup

- ✓ **Cameras:** 5 MPx Flir BFS-U3-51S5M-C
- ✓ **Lens:** Fujinon 25 mm
- ✓ **Extensometer:** Length = 500 Pix, Subset = 75 Pix
- ✓ **Extensometer:** 1D
- ✓ **Tensile bench:** MTS 10 kN
- ✓ **Feedback using:** MatchID feedback unit

Analysis

- ✓ **Type:** 2D DIC
- ✓ **Quantity live-tracked:** DIC extensometer-measured engineering strain
- ✓ **Test-abort criterion:** engineering strain ≥ 1%
- ✓ **Analyzed quantities**: Time, load and the live-tracked engineering strain from the test bench

Results

- ✓ Following curves from the MTS Elite:
  1. Load-displacement
  2. Load-engineering strain
- ✓ Extensometer **resolution**
  - 7 µε
- ✓ Test bench test-stop criterion

Why MatchID

- ✓ **Live tracking of DIC quantities:** Compared to video-extensometry, the underlying speckle pattern allows to embed shape functions in the displacement derivation, resulting in higher accuracy.
- ✓ **MatchID feedback unit:** Easy communication between the DIC setup and your test bench
- ✓ **Optimized test design and control:** quantified speckle patterns combined with polarization

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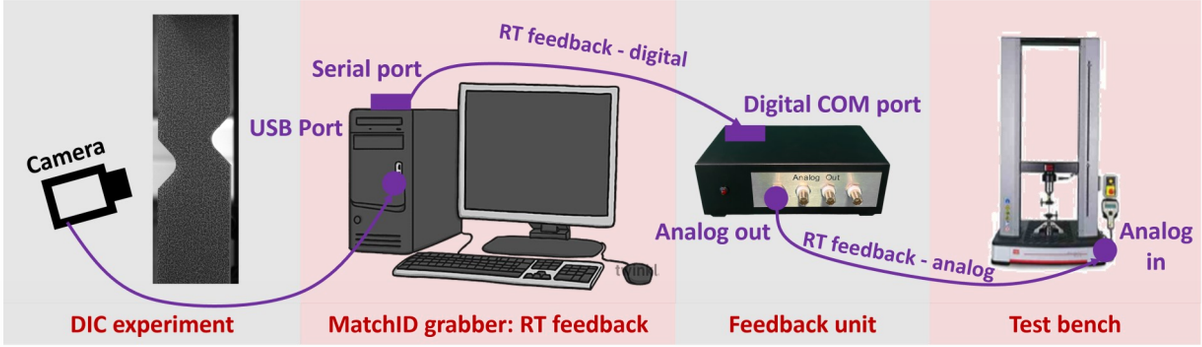
Test configuration

Test configuration to establish a channel of communication between the test bench and the DIC system.

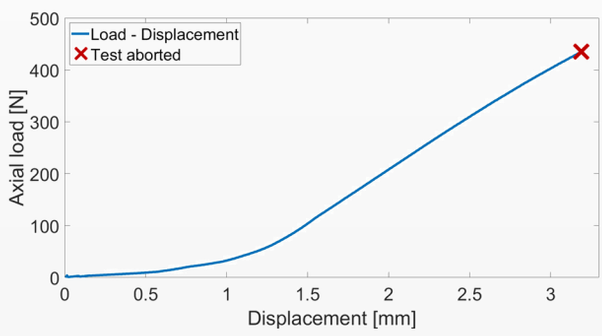
1. The computer serial port was used to send a live-tracked DIC measured quantity as a digital signal.
2. The MatchID feedback unit converted the digital signal to an analog voltage.
3. The analog voltage was then read by the test bench as an external analog signal.

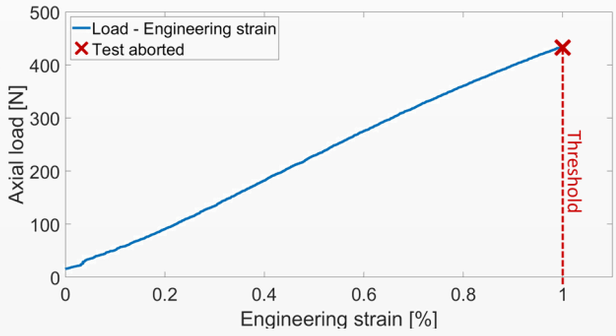


Test results

Load-displacement curve: Shown in the figure below on the left. Initially, there is a clear indication of the test sample slipping in the grips. This can obviously not be revealed by the default crosshead displacement. For displacements exceeding approximately 1.5 mm, the load-displacement curve is fairly linear.

Load-engineering strain curve: Shown in the figure below on the right. The curve is fairly linear as expected. The tensile test was automatically stopped when the preset strain threshold of 1% was reached as planned.





Perspectives

Conclusion:

✓ A communication between the DIC setup and the test bench can be successfully established using the live-tracking and RT-feedback features in the MatchID Grabber coupled with the MatchID feedback unit.

Perspectives

✓ Multiple transverse extensometers allowing to send local necking information to the test bench.

✓ Step-wise control of loading-unloading cycles.

✓ Since MatchID integrates a vast amount of material models, this opens the door for novel testing approaches that rely on post-processed quantities, as e.g. the von Mises stress.