



Stereo [Dynamic Deformation Measurement]

The Linearis3D Stereo System

The Linearis3D Stereo system is designed for dynamic deformation measurements of large construction parts. Typical applications are thermal stress tests. Objects up to 10m x 6m and more pose no problems. The system includes the following elements:

- + Two high-resolution DSLR cameras
- + High-speed video cameras (Optional)
- + High-performance laptop computer
- + Linearis3D Stereo Software
- + Wireless camera remote control
- + Tripods and carrying case
- + Markers and accessories
- + WLAN transmitters (Optional)

Advantages

The system has many advantages:

- + Arbitrary number of measurement points
- + Measurement frequency up to 0.1 Hz (any frequency possible using video cameras)
- + High accuracy
- + Safe, non-contact measurement
- + Cameras can be positioned freely in front of the object
- + Compensation of camera displacements
- + Wireless triggers for the cameras
- + Completely wireless, battery powered operation
- + Easy to use

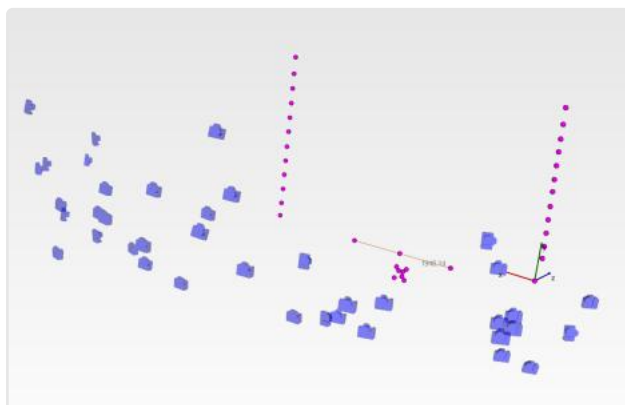


Figure 1: 3D calibration of the test bench.

Applications & Industries

Typical applications include testing and measurement in construction and fire protection as well as research projects in structural engineering. Typical users are:

- + Test and research facilities
- + Manufacturers of construction elements
- + Regulatory agencies

Measurement Procedure

Calibration of reference markers

Reference markers are attached on the left and right of the test installation. The stereo cameras use these markers to determine their position in space. As a result small movements of the cameras during actual testing are unproblematic.

The 3D-positions of the reference markers are measured using the photogrammetry module of the system. To that end the markers are photographed from different perspectives. Their precise positions are computed based on about 50 photographs. The entire process takes only a few minutes. The calibration has to be repeated only when the reference markers' positions change. Figure 1 shows the camera positions in blue and the markers in magenta.

Stereo Measurement

The cameras can be placed freely in front of the test object (Figure 2 and 3). The points to be measured are referenced



Figure 2: The Stereo system in action.

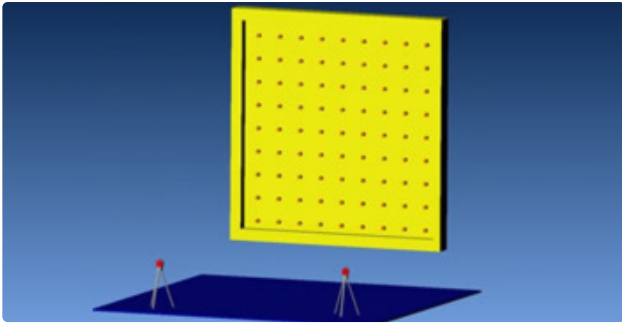


Figure 3: True to scale measurement setup.

by small adhesive white circles. The measurement is triggered manually or in programmed intervals using a wireless remote control. The images may be directly transferred to the computer via WLAN and will be evaluated almost in real-time.

Evaluation

The analysis is done automatically and returns real three-dimensional data. The number of measurement points is only limited by memory. Optional real-time analysis of the data via WLAN is possible. All measurement results are exported as an Excel or text file.

Technology

The Linearis3D Stereo system is based on state-of-the-art photogrammetric methods. Using sophisticated image processing algorithms, the marked data points are extracted from the images. The integrated bundle adjustment is used for the computation of 3D deformations. This is considered to be the gold standard for precision applications. Each system is verified in-house following a comprehensive evaluation process. The verification setup at Linearis3D is shown in Figure 6.

For large slowly deforming measurement objects we recommend DSLR cameras, for smaller rapidly deforming objects we use high speed video cameras (Figure 5).

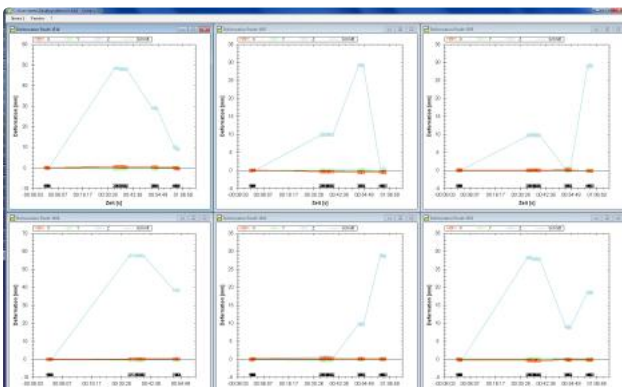


Figure 4: User interface of the analysis software.



Figure 5: Optional video cameras for high-speed applications.

Company

We are a technology company based in Brunswick (Braunschweig), Germany. Our goal at Linearis3D is to develop innovative products and services based on photogrammetry technology. One objective of our work are customized solutions. With our own code base and extensive hardware experience we take solving unusual problems a step further.

Contact

Linearis3D GmbH & Co. KG
 Rebenring 31
 D-38106 Braunschweig, Germany
 Phone 0049 . (0) 531 . 47 220 36 – 0
 kontakt@linearis3d.de
 www.linearis3d.de

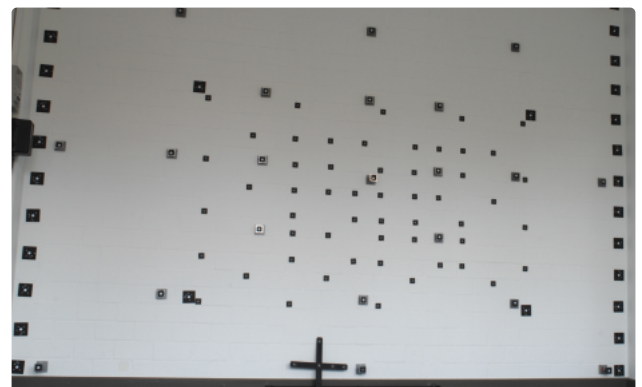


Figure 6: Verification setup at Linearis3D. Reference markers left and right, measurement points in the middle.