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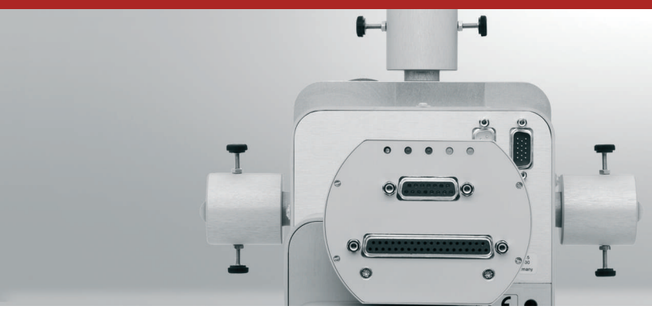

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ESPI

Speckle Pattern Interferometer

3D Deformation Measurement
Sub-Micron Resolution

gom Optical Measuring Techniques

ESPI

Speckle Pattern Interferometer

Important factors in the product development process are the component optimization, usage of new materials and the improvement of numerical calculation models. In all these areas a better understanding of the material and component behavior is a challenge to experimental measuring methods.

The interferometrical method ESPI is well suited to measure smallest 3D displacement and plane strain with a resolution of approx. 10 nanometers or 1 micrometer per meter. Due to such high sensitivity, smallest deformation in brittle materials like concrete and ceramics can be investigated.

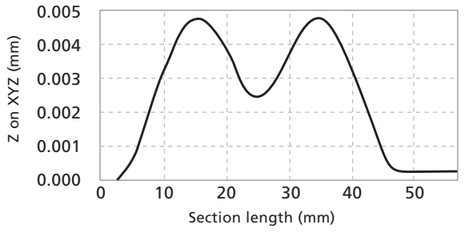
Applications

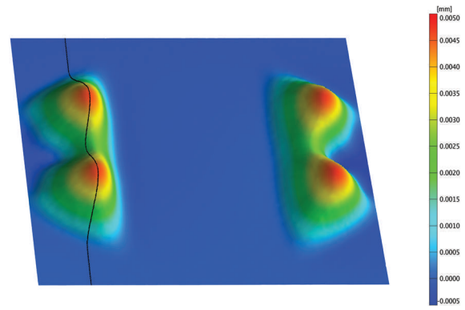
The ESPI systems are used for a wide variety of industrial and research applications. The high measuring resolution in the determination of deformation and strain is well suited for:

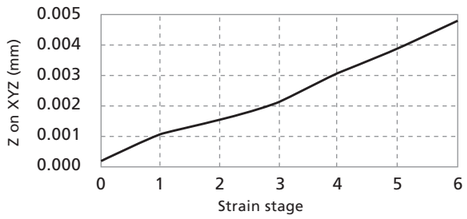
- Material testing
- Strength assessment
- Optimization of constructions
- Investigations of linear and non-linear behavior
- Characterization of creep and aging properties
- Verification of numerical simulations
- Characterization of heterogeneous materials

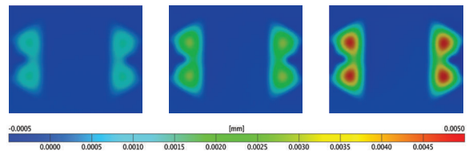
Features

- Simple operation: The compact sensor head mounted on a robust test arrangement along with the user-friendly software allows a quick training and efficient measurements.
- Flexibility: The same sensor measures small and large objects (10mm up to 600mm).
- Non-contact measurement: The ESPI systems measure without contact, therefore no force and no sensor mass is applied.
- Full-field and graphic results: High data point density and graphic display of the results lead to a better understanding of the component under load.
- Mobility: Due to the compact construction, the ESPI systems are ideally suited to measure workpieces and components on-site.







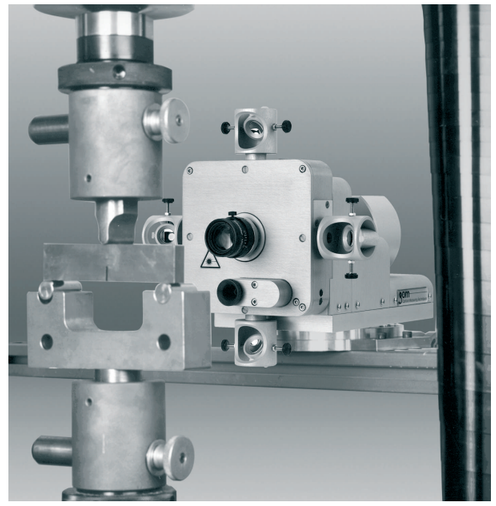


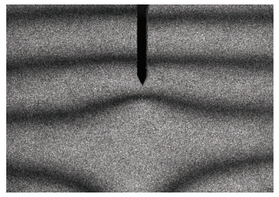
Technology

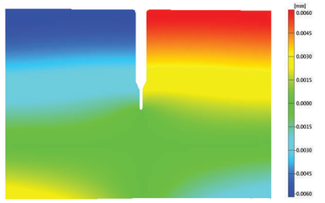
The speckle pattern interferometry uses the interference characteristics of electromagnetic waves. It is based on the fact that an optically rough surface appears granulated when lit by a coherent light. The individual grains are called speckle, the phenomenon is called a speckle pattern.

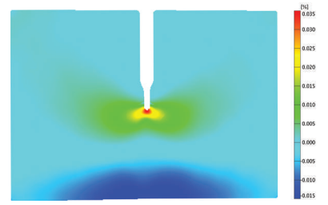
The ESPI sensor illuminates the measurement object with laser light from multiple directions. A CCD camera records the reflected speckle pattern. By subtracting speckle patterns from various load stages, interference fringes are formed. The number of fringes and their widths are a measure for the displacements of the illuminated area.

Automatic evaluation of the measurement by real-time subtraction and phase-shifting algorithms is possible. Depending on the illumination direction of the laser, displacements in X, Y and Z direction can be obtained. Finally, the strain information is derived from these displacements.



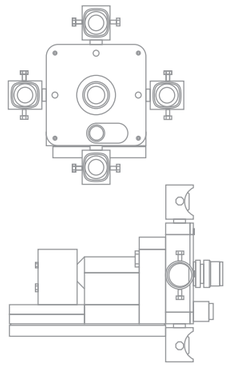






Software

Measurement data are visualized full field in interactive 3D views, providing an easy understanding of deformation distributions. Sectional analysis, point based analysis and statistics allow a further detailed evaluation of the specimen behavior. For the verification of numerical simulation results, geometric element functions and multiple 3D transformations allow to place the measurement data in proper 3D coordinate position. All results are visualized in user-definable measurement reports. These reports, animations or final result data may then be exported in standard or user-defined file formats.



Technical Data	
System Configurations	SD-30 / SD-10S
Sensor Dimensions	220 x 220 x 300 mm³
Weight	5 kg
Camera Resolution	1280 x 1024 pixels
Laser	3 x 50 mW / 785 nm
External Laser	optional
Measuring Area	10 x 8 - 600 x 450 mm²
Stand Off	100 - 800 mm
Measuring Direction (SD-30)	X, Y, Z
Measuring Direction (SD-10S)	X or Y or Z
Accuracy	10 nm