ARAMIS

Optical 3D Deformation Analysis

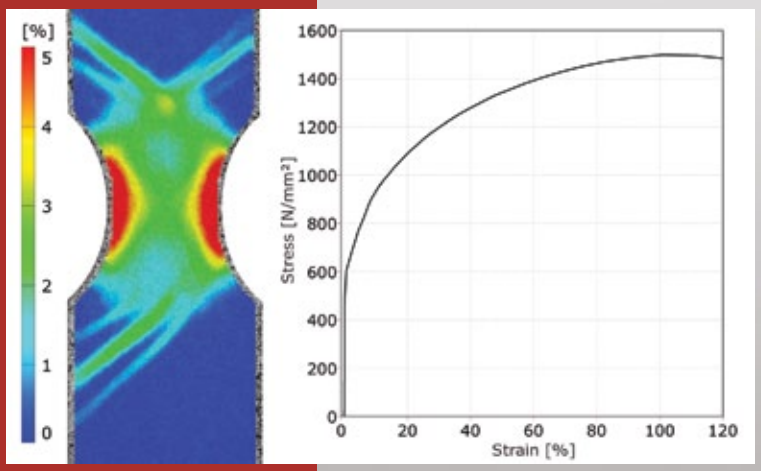
3D Surface - Displacements - Strains
in Material and Component Testing

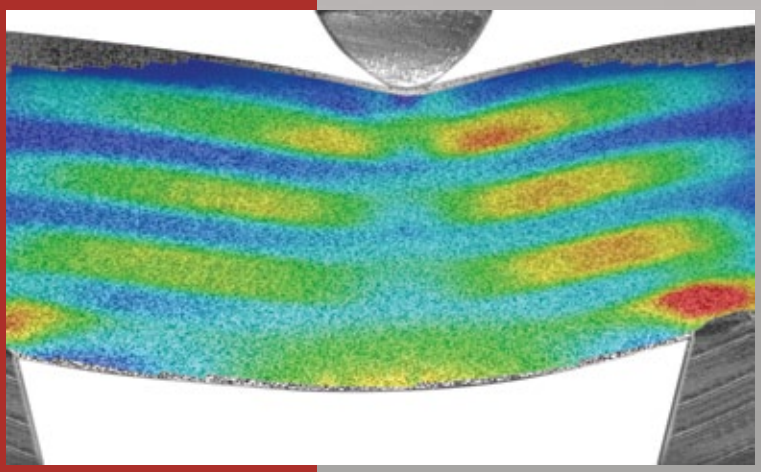
gom
Optical Measuring Techniques

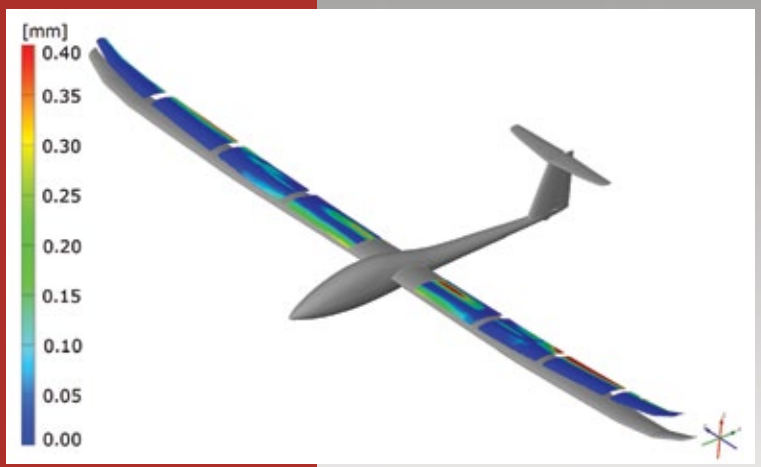
ARAMIS

Optical 3D Deformation Analysis

ARAMIS helps to better understand material and component behavior and is ideally suited to monitor experiments with high temporal and local resolution. ARAMIS is a non-contact and material independent measuring system providing, for static or dynamically loaded test objects, accurate:







- 3D surface coordinates
- 3D displacements and velocities
- Surface strain values
- Strain rates

Unlike other techniques, ARAMIS is a robust solution for full-field analysis of small specimens (mm) up to large components (multiple 10 m). Measurements are carried out independently from geometry and temperature without time-consuming and expensive specimen preparation.

ARAMIS is the solution for ...

- Determination of material properties
- Component analysis
- Verification of Finite Element Analysis
- Real-Time controlling of testing devices

ARAMIS Features

- Non-contact
- Material independent
- Geometry independent
- 2D and 3D measurement
- Mobile and flexible
- Full-field
- High accuracy
- High temperature
- High speed
- Easy specimen preparation
- Integration in testing environments
- Smallest to largest object sizes
- Smallest to largest deformations

Sub-pixel accurate image processing for 3D surface, displacement and strain measurement

ARAMIS evaluates high-resolution images recorded from any test object during loading. With the help of adjustment computations, a precise mathematical calibration model of the sensor setup is calculated including camera positions and lens distortion parameters.

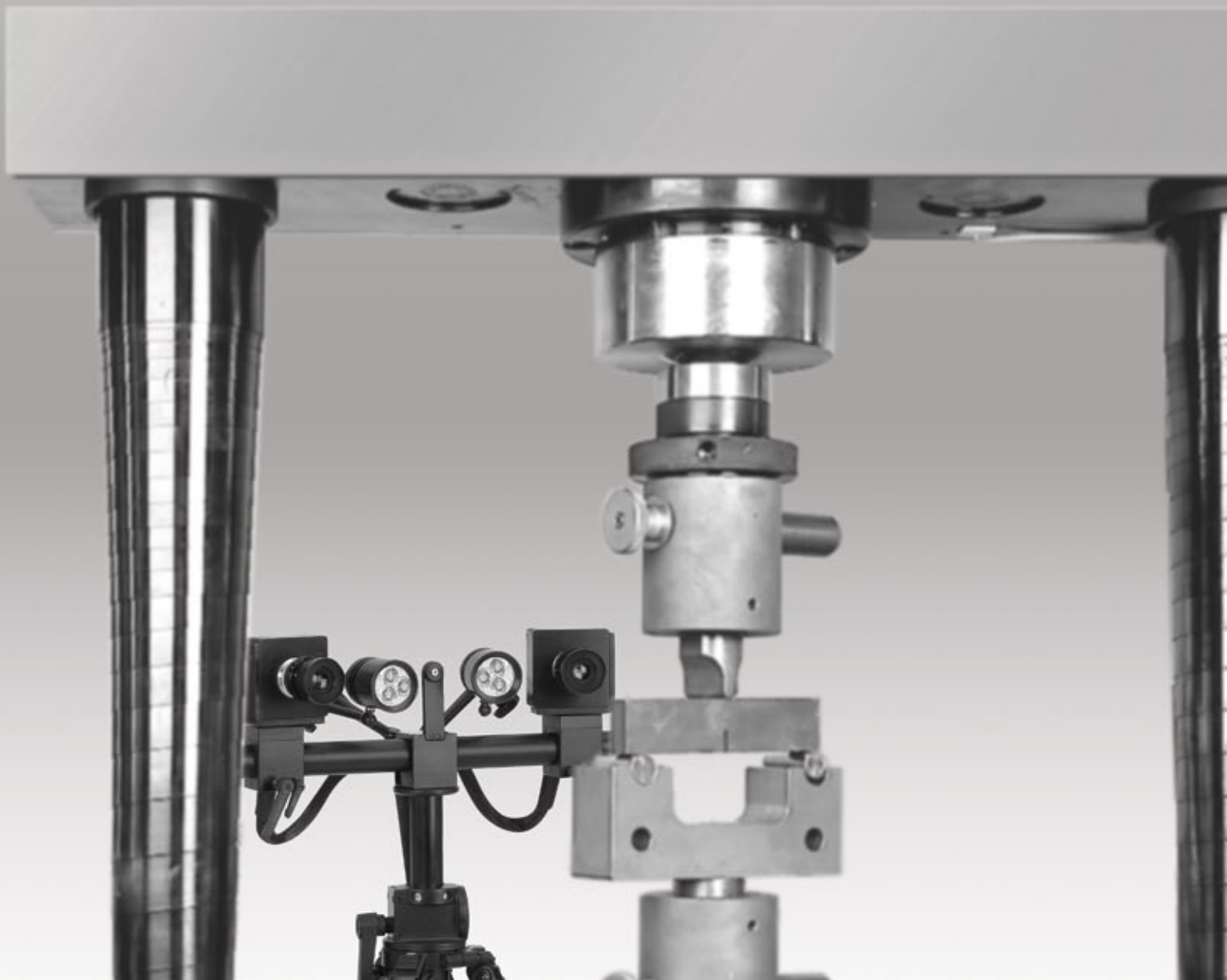
The image processing is based on the principle of digital image correlation. Grey value distributions are calculated for a large amount of small subsets in each camera image and provide sub-pixel accurate positions about corresponding points between all images.

The mathematical model of the sensor setup, the digital image correlation method and a triangulation calculation are combined to derive high accurate 3D coordinates. Subtracting the surface information in all loading stages in 3D space provides precise X,Y and Z displacement values.

Strains are calculated considering the component's geometry and plasticity theory. As the image acquisition is time-based, 3D velocities and strain rates are automatically achieved.

ARAMIS provides the measurement results as

- Full-field 3D coordinates, displacements and strains
- Fine resolution 3D mesh
- Plain strain tensor
- Object contour based visualization



ARAMIS

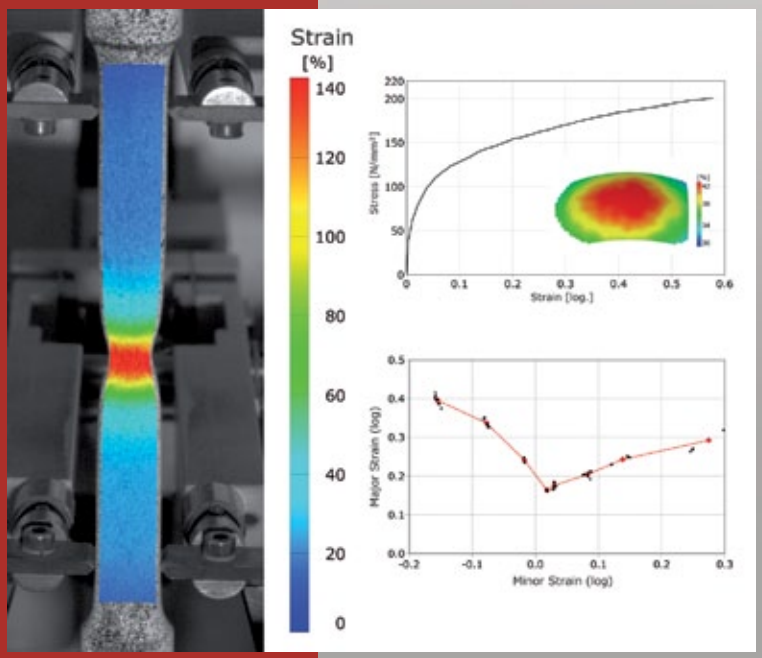
Measuring for a better understanding

Important factors in product development processes are the dimensioning of components, the exact determination of material properties and the validation of FE calculation models. ARAMIS helps to better understand material and component behavior.

Material testing

The precise full-field ARAMIS results improve the accuracy of material characteristic values.

Existing evaluation procedures are enhanced and thus more reliable, like the determination of flow curves and forming limit curves. A lot of material tests can only be evaluated because of the non-contact measurement and the high local resolution ARAMIS results.

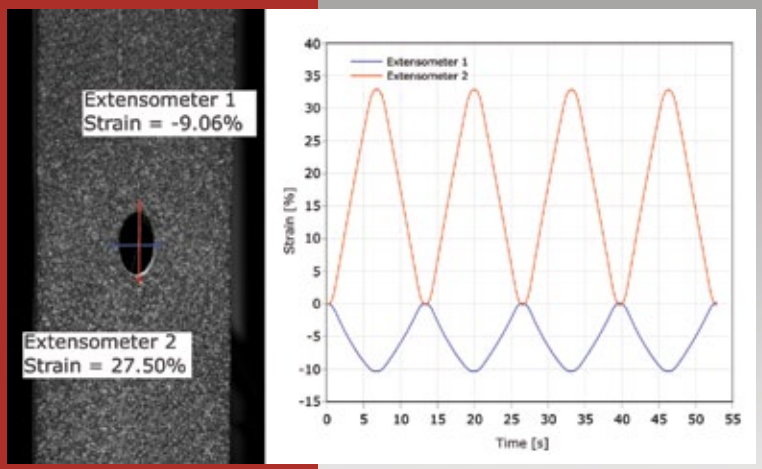


- High temperature tests
- High speed tests
- Very small specimen sizes

Today, ARAMIS is an established and proven measuring solution in hundreds of material research facilities around the world for:

- Strain-Stress evaluation
- R-Values
- Poisson ratio
- Young's modulus
- Forming limit curves
- Residual stress
- Shear modulus

Real-Time 3D measuring



ARAMIS provides real-time results for multiple measurement positions on a specimen's surface. These are directly transferred to testing devices, data acquisition units or processing softwares (e.g. LabView, DIAdem, MSExcel, etc.) and are used for

- Controlling of testing devices
- Long-term tests with smallest storage requirements
- Vibration analysis
- 3D Video Extensometer

Component testing and analysis

ARAMIS is the right tool for the understanding of the component itself as it is

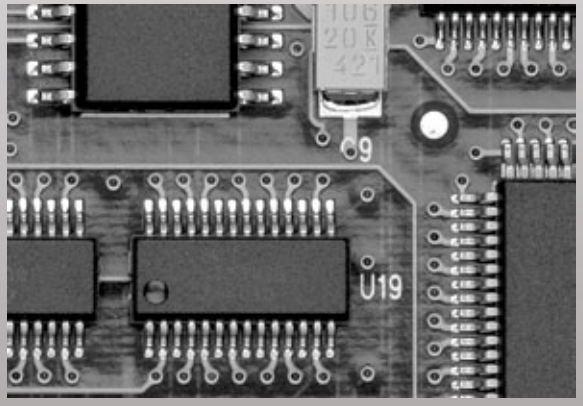
- independent from material, size and geometry
- and measuring under real-use conditions.

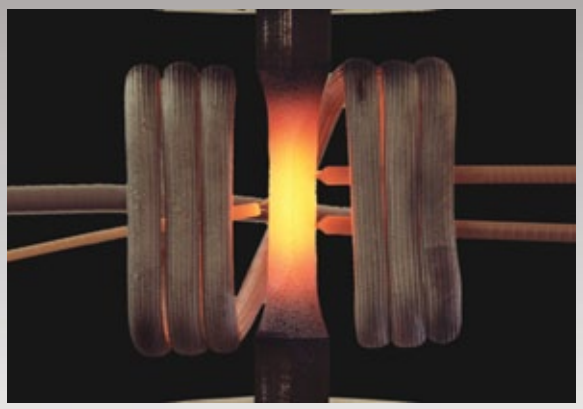
ARAMIS considers the real component geometry which would not be possible with traditional measuring devices like strain gauges, displacement sensors (LVDT), vibrometers, etc.

3D measurement results are always required as a 3D object leads to non-linear deformation behavior. ARAMIS links to the component's original 3D CAD data for transformations, direct comparisons and visualizations.

ARAMIS provides all results for static and dynamic tests even at high speeds for smallest to largest components for

- Strength assessment
- Vibration analysis
- Durability studies
- Crash tests





Finite Element Analysis

New products and production processes are designed and optimized with numerical simulation methods. Material parameters and component deformation behavior have a significant influence on the accuracy of simulation calculations and their reliability.

ARAMIS is used for the determination of material parameters as FE input values and the validation of numerical simulations by calculating the differences between experimental measurements and FE data.

ARAMIS

The basic workflow

Preparation
The mobile ARAMIS sensor is adjusted to the required specimen size and positioned in front of the specimen.

Measurement
ARAMIS acquires the images and analog data during loading of the component.

- User-definable image acquisition
- Flexible triggering (manual, time sequence, TTL, analog signals)
- Integrated data logger
- Real-Time measurement

Evaluation
ARAMIS automatically computes 3D coordinates for all loading stages and derives surface, displacement and strain results.

- Computation of material parameters
- CAD import and comparison
- Coordinate transformation (3-2-1, CAD, Best-Fit, ...)
- Rigid body motion compensation
- Calculation of geometrical elements (cylinders, circles, cones, spheres, planes, ...)
- Evaluation of acquired analog data
- Comparison to Finite Element Simulation including import and export

Reporting
The ARAMIS reporting engine is based on templates for complete automatic report generation. All results are available for user-definable 3D visualizations, diagrams, tables, videos, images and can be exported in standard file formats.

ARAMIS Advantages

Non-contact 3D surface, displacements and strains
ARAMIS is the unique solution delivering complete 3D surface, displacement and strain results where a large number of traditional measuring devices are required (strain gauges, LVDTs, extensometers, …).

Local and global deformation behavior
ARAMIS results are comparable to values from hundreds or thousands of strain gauges, LVDTs and extensometers on one specimen. These full-field measurement data represent local effects and global deformations for an easy understanding of material and component behavior.

More information - faster
ARAMIS preparation and setup is easy, leading to quickly available measuring results.

From smallest to largest strains
ARAMIS is the only reasonable method to measure from smallest strains to multiple hundred percent deformation (e.g. polymer specimens with 1000% strain).

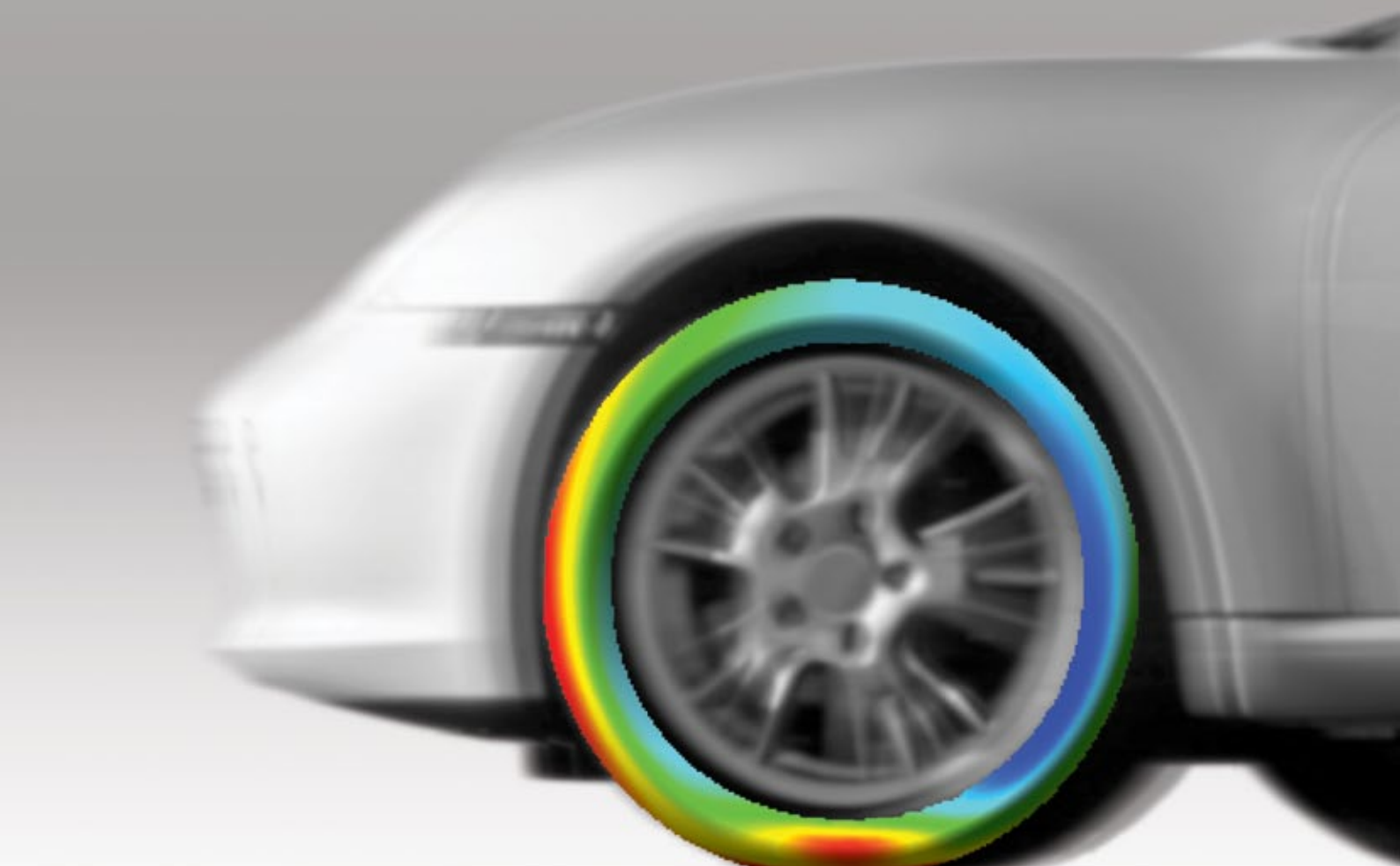
Matching the applications
ARAMIS can be set up to meet optimum measuring speeds, resolutions and areas of interest.

Sensor Controller
ARAMIS comes with an integrated sensor controller which allows adaptation to the testing environment. This controller is used for aligning the image acquisition to the test procedure, recoding analog values and communicating with testing devices.

The sensor controller is specially developed by GOM to provide an automated and secure integration in material and component testing process chains.

Process reliability
The ARAMIS sensor is based on GOM's proven stereo-camera technique, guaranteeing

- Compensating for environmental influences (e.g. room temperature, vibration)
- Monitoring the sensor calibration automatically
- Identifying and compensating rigid body motion



ARAMIS

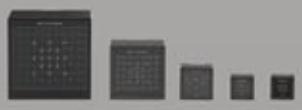
The Complete ARAMIS System

Cameras
- CCD and CMOS cameras
- Different image resolutions
- Adjustable image size
- User-definable acquisition speeds to meet application requirements
- Stable and certified lenses

Sensor
- Adjustable or fixed camera frame
- Robust and stable
- No tools for sensor adjustment required
- Integrated object illumination
- Integrated laser pointer for simplified positioning

Sensor Controller
- Power supply for cameras, illumination and positioning pointer
- Trigger unit
- Synchronized image acquisition
- Analogue data input and output

Computer / Notebook
- 64 bit processing power
- Industrial grade and certified components



Transport Cases
- Adjustable work plate for sitting or standing working height
- Robust and proven sensor protection case

Certification
- Certified calibration artifacts
- NIST and PTB certified software algorithms
- FCC certified computer

Software
- Complete software from one source

ARAMIS Technical Data




Configuration	5M	4M	12M	HS	High Speed
Frame Rate	15Hz up to 29Hz	60Hz up to 480Hz	24Hz up to 200Hz	500Hz up to 4000Hz	5kHz up to 1MHz
Camera Resolution	2448 x 2050 px	2358 x 1728 px	4096 x 3072 px	1280 x 1024 px	up to 1024 x 1024 px
Measuring Area			mm² to > m²		
Strain Measuring Range			0.01 % up to >100%		
Strain Measuring Accuracy			up to 0.01 %		
Ring Buffer	•	•	•	•	•
Image Memory	uses PC RAM	uses PC RAM	uses PC RAM	uses PC RAM	camera RAM
Camera Frame	adjustable/fixed	adjustable/fixed	adjustable/fixed	adjustable/fixed	adjustable
Tool Free Mounting	•	•	•	•	-
Integrated Cable Guide	•	•	•	•	-
Positioning Pointers	1 or 3	1 or 3	1 or 3	1 or 3	-
Illumination	integrated	integrated	integrated	external	external
High-End Rack Mount PC	•	•	•	•	•
Notebook	•	-	-	-	•
Control Device	sensor controller	sensor controller	sensor controller	sensor controller	optional
Sensor Dimensions (height x depth)	175 x 180 mm	235 x 185 mm	215 x 185 mm	230 x 185 mm	
Sensor Dimensions (length)	variable	variable	variable	variable	variable
Weight	5 kg	6.5 kg	6.5 kg	6 kg	
Operating Temperature	5 – 40°	5 – 40°	5 – 40°	5 – 40°	5 – 40°
Humidity	non-condensing	non-condensing	non-condensing	non-condensing	non-condensing
Power Supply	90-230V AC	90-230V AC	90-230V AC	90-230V AC	90-230V AC

Additional sensor configurations available on request.

Sensor Controller Technical Data

Analog Input		Analog Output	
Channels	8	Channels	4
Digital Resolution	16 bit	Digital Resolution	12 bit
Voltage Range	-10 V to +10 V	Voltage Range	0 V to +10 V
Sampling Frequency	up to 100 kHz	Sampling Frequency	up to 500 Hz
Trigger			pre / direct / post
Event List Based Triggering			points in time, analog values, external signals
Power for			cameras, illumination, positioning pointers
Communication / Data Transfer			gigabit ethernet (TCP/IP)
Dimensions			445 x 44 x 370 mm³
Weight			2.8 kg
Operating Temperature			5 – 40°
Humidity			non-condensing
Power Supply			90-230V AC

ARAMIS

Turn-key solution

GOM provides a complete solution with the ARAMIS system for measuring, evaluation and reporting.

- Optimized workflows – time saving
- User friendly – one training session
- One support contact

GOM completely develops the ARAMIS hardware and software in house. The software is designed to run the sensor and controller, to process all measurements, to automatically compute result data and to perform post-processing.

ARAMIS is an industrial grade solution providing all necessary functionalities even for complex research tasks.

ARAMIS is integrated in standard process chains through versatile import and export capabilities. Material parameters, testing device outputs and data logs are imported and used for further calculation of characteristic values.

CAD data are used for transformations and deviation calculations.

- Native: Catia v4/v5, UG, ProE
- General: IGES, STL, VDA, STEP

To close the process loop, all result data are exported in standard or free definable formats.

All workflows are available for automated use with a record and play procedure. New analysis models can easily be implemented by the operator and added to the standard evaluation as ARAMIS offers a scripting interface.

All built-in features enable ARAMIS to:

- Integrate in existing testing and measuring workflows
- Link with existing evaluation strategies
- Adapt to any measuring and evaluation task

Development, construction, support all in one

The “Gesellschaft für Optische Messtechnik” (GOM) develops, produces and distributes optical measuring equipment for the three-dimensional coordinate measurement and deformation measurement of components. The measuring systems are based on digital image processing and are used in material and component testing, product development and quality assurance.

All over the world, companies of the automotive, aviation and space industries, their suppliers and various manufacturers of consumer goods as well as research facilities use GOM systems.

GOM was founded in 1990 as spin-off of the Technical University Braunschweig, Germany. The company owns subsidiaries in Switzerland, France, Great Britain, Italy and Belgium. Worldwide, more than 35 committed and competent partners install, support and market GOM products.

Today, GOM offers a complete in-house solution covering hardware, software, technical support and training.

GOM customers (extract)

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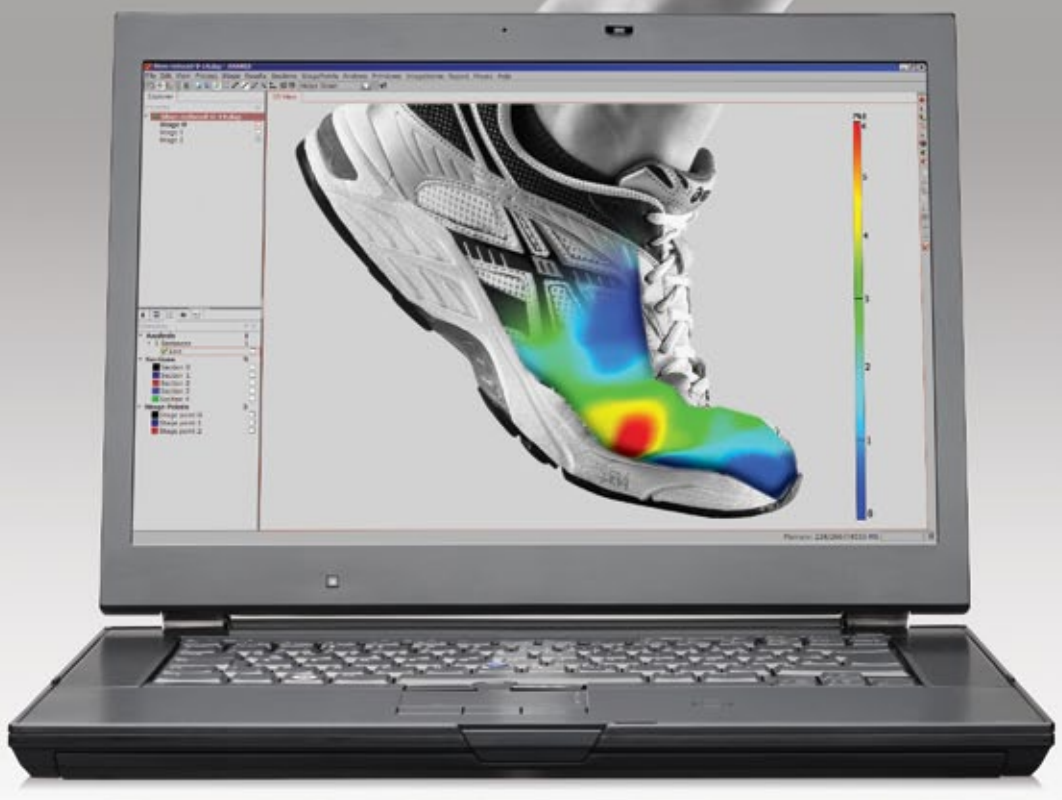

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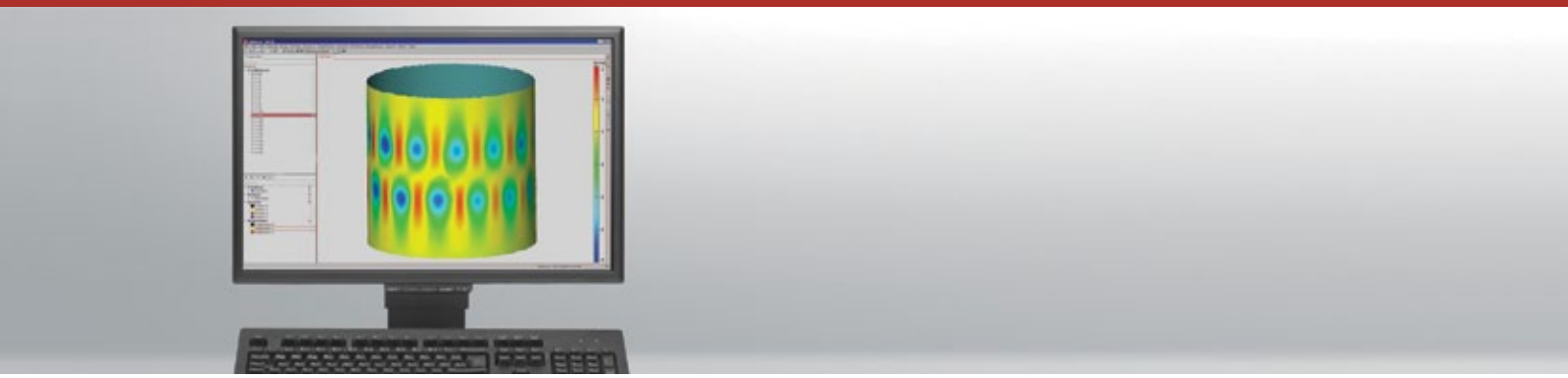

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