ARAMIS

Optical 3D measurements of strain, deformation and displacement

Certified
Metrology Partner

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Non-Contact Measurements

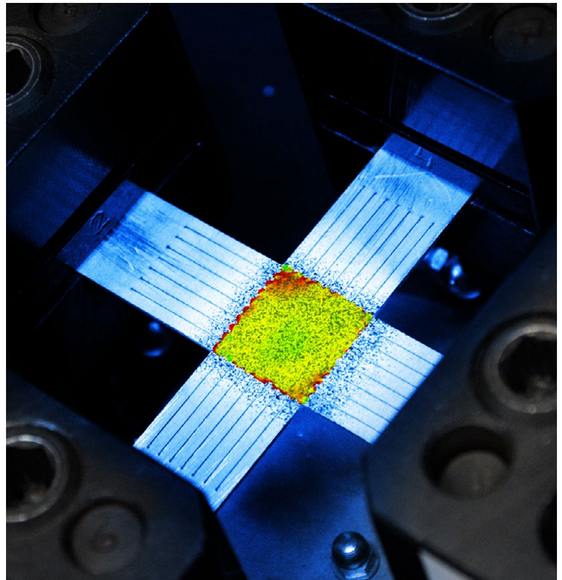
Full-field and point-based

ARAMIS is an optical 3D measuring solution used for materials characterization, component testing and motion analysis. It delivers precise 3D coordinates for statically or dynamically loaded specimens and parts, enabling the determination of 3D displacements, velocities, accelerations and strain as well as measurements of 6 degrees of freedom (6DoF).

The mobile system is suitable for testing all materials, geometries and object sizes – from specimens of just a few millimeters up to structural components of several meters. The 3D measuring resolution reaches down to the submicrometer range – irrespective of the specimen temperature.

The measuring solution determines a dense mesh of easy-to-understand data, offering full-field and point-based analysis options: The distribution of strain is detected full-field. At the same time, ARAMIS monitors any number of measuring points on the part surface. The results are visually presented and documented in reports.

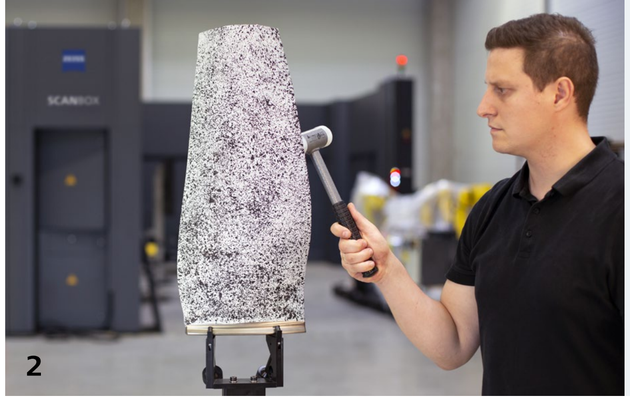
As the cameras measure the deformation in each spatial direction, time-consuming and expensive preparations of the test object, for example, applying strain gauges or LVDTs and accelerometers for low-frequency applications, are no longer necessary.



Backbone of the Process Chain

ARAMIS supports you throughout the entire product development process. Based on comprehensive, easy-to-understand measuring results, you can make reliable decisions and reduce time to market significantly.

1



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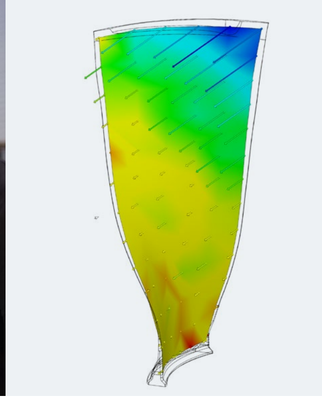

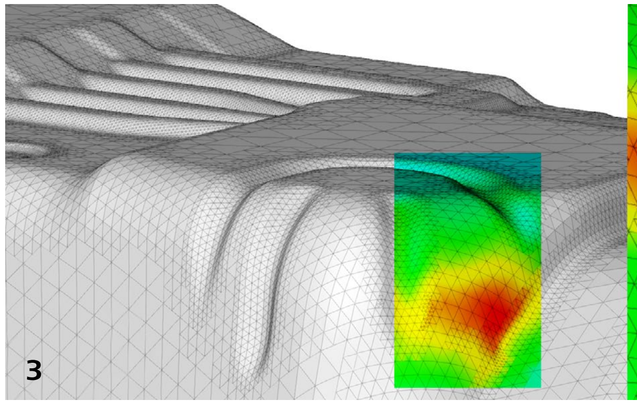

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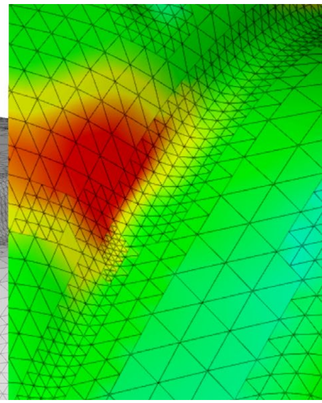


1 Materials characterization

Precise, full-field ARAMIS measuring results improve the accuracy of material characteristics. Existing evaluation procedures are optimized and become more reliable, such as the determination of flow curves and forming limit curves. Some material tests can only be performed due to the non-contact method of ARAMIS measurements and the high local resolution of the results. This is applied to tensile, shear, compression and 3-point bending tests as well as to high-speed and temperature tests.

2 Prototype testing

ARAMIS is used for strength and vibration analyses, fatigue limit and crash tests. The measuring results form the basis for determining product durability and load limits and for optimizing the geometrical layout. During load testing, the system measures the real part geometry along with the non-linear deformation behavior and allows for direct comparison with FEM data.

3 Validating numerical simulations

ARAMIS sensors provide information on material properties, the deformation behavior of parts and the boundary conditions of test setups. The measurement data are used as input parameters for simulation computations and for optimization and validation of FEA models. The software allows for importing FE data from ABAQUS, PAMSTAMP, LS-DYNA and ANSYS, AUTOFORM as well as for aligning them in 3D to the measuring data and in space.

ARAMIS Technology

Using high-quality cameras, the ARAMIS system measures specimens under load. The evaluation of the captured images and visualization of the measuring results is executed by the proprietary software ZEISS INSPECT Correlate.

- **Sub-pixel accurate image processing**
- **ARAMIS Controller**
- **Touch probes and optomechanical adapters**
- **Certified accuracy**

Sub-pixel accurate image processing

Precise measuring data from mechanical testing require perfectly prepared test setups. This also includes the preparation of the specimen's surface: If full-field measuring data acquisition is required, a stochastic contrast pattern is applied to the surface. Alternatively – or additionally – circular measuring markers are applied and serve as a reference for point tracking. Using the methods of mathematical adjustment computation, the system computes a mathematical calibration model of the sensor, including camera positions and lens distortion parameters.

The combination of the mathematical sensor calibration model, the captured measuring data and the triangulation method results in highly accurate 3D coordinates. The surface information evaluation of all load levels provides exact X, Y and Z displacement values in 3D space and information on surface strain.

Model Variants

ARAMIS is available in two variants and different configurations.
This ensures that you receive a system tailored to your specific needs.

ARAMIS 3D Camera

ARAMIS Adjustable

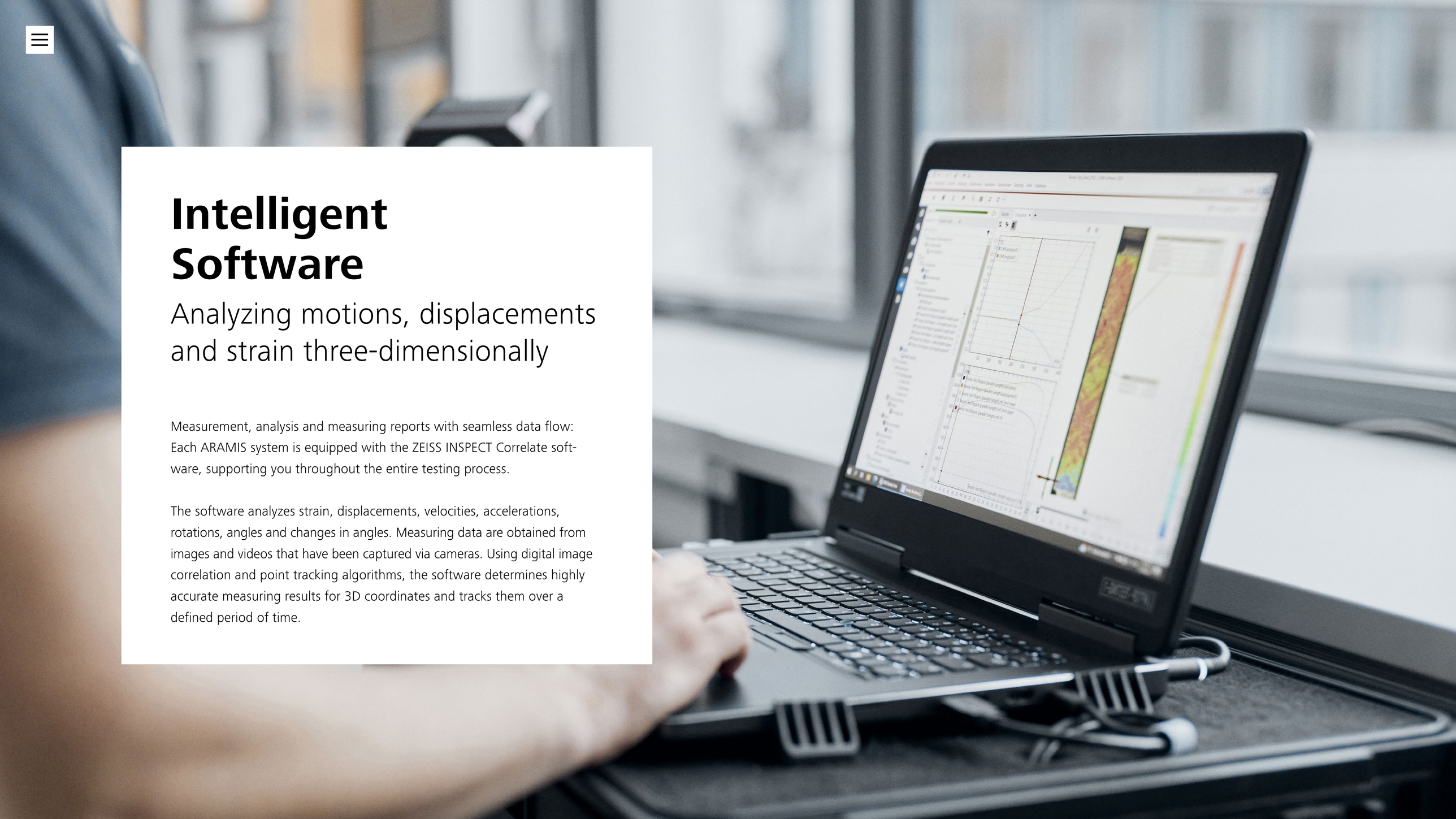
Multisensor setups

Combining several ARAMIS sensors allows for simultaneous measurements from various perspectives with different measuring areas. The transformation of several ARAMIS projects into a common coordinate system is accomplished with the digital TRITOP photogrammetry system. Consequently, **several** local ARAMIS measurements can be combined for an overall evaluation.

ARAMIS Adjustable

The modularly expandable ARAMIS Adjustable measuring solution is a cost-effective entry point into the world of optical 3D strain and motion analysis. Thanks to variable measuring volumes and distances, the sensors can be used flexibly for different measuring tasks. The illumination solutions can be positioned flexibly and allow for optimal illumination of the test objects – matching the size and dynamics of the test. This makes the system ideal for research centers and universities working on various applications.

	ARAMIS Adjustable 12M	**ARAMIS Adjustable 24M**	**ARAMIS Adjustable SRX**	**High Speed**
Camera resolution	4096 × 3000 pixels	5312 × 4448 pixels	4096 × 3068 pixels	bis zu 2048 × 2048 pixels
Frame rate (fps)	up to 150 fps	100 fps (up to 360 fps)	75 fps (up to 480 fps)	e. g. 6400 fps (up to 200000 fps) e. g. 16000 fps (up to 1000000 fps)
Camera support (mm)	20 × 15 mm² up to 5000 × 4000 mm²	20 × 18 mm² up to 5000 × 4500 mm²	33 × 25 mm² up to 5000 × 4000 mm²	10 × 10 mm² up to 5000 × 5000 mm²



Intelligent Software

Analyzing motions, displacements and strain three-dimensionally

Measurement, analysis and measuring reports with seamless data flow: Each ARAMIS system is equipped with the ZEISS INSPECT Correlate software, supporting you throughout the entire testing process.

The software analyzes strain, displacements, velocities, accelerations, rotations, angles and changes in angles. Measuring data are obtained from images and videos that have been captured via cameras. Using digital image correlation and point tracking algorithms, the software determines highly accurate measuring results for 3D coordinates and tracks them over a defined period of time.

ZEISS INSPECT Correlate

Live deformation tracking with data streaming

Live tracking is used, for example, in long-term tests, fatigue tests as well as in wind tunnel tests and vibration analysis. The measuring results can be viewed online or processed live by other programs.

Optical strain gauge, extensometer and LVDT – all in one

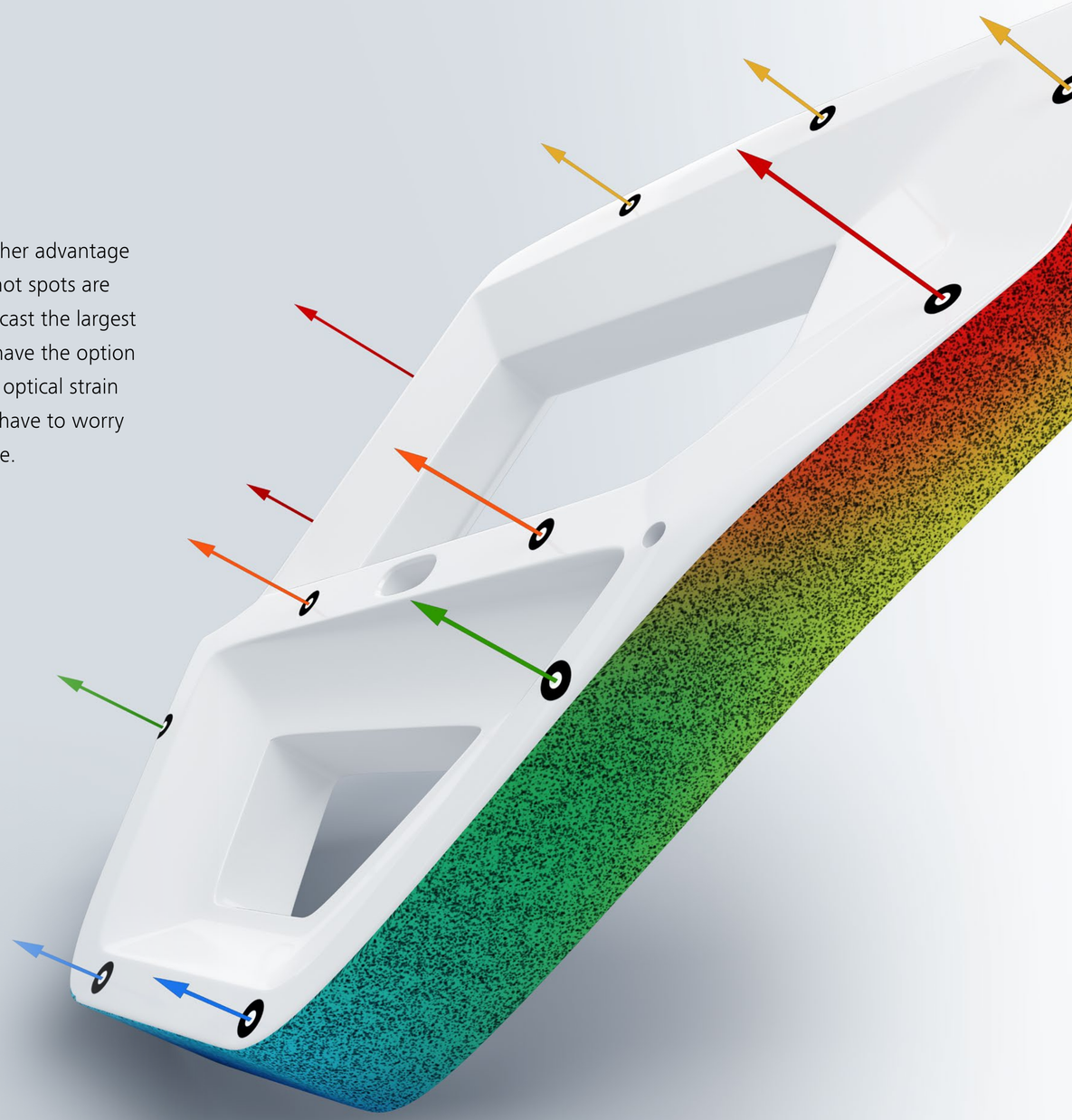
Based on the optically measured data, strain gauges, extensometers and LVDTs were integrated into the software. This allows the reliable measurement of longitudinal and transverse strain at many points without influencing the surface structure of the specimen. In particular, inhomogeneous deformation phenomenons, such as necking and flow fronts, can be analyzed in more detail.

Due to obtaining data on a large scale, another advantage of optical sensors is that unexpected strain hot spots are measured, even if the simulation model forecast the largest deformation at a different position. As you have the option to subsequently change the positions of the optical strain gauges, extensometers or LVDTs, you never have to worry about incorrectly positioned sensors anymore.

Free trial version

Get to know the numerous benefits of the software – free and without any contractual obligations for 14 days.

Learn more



AEROSPACE

High Precision

for safe take-off

In the aerospace sector, ARAMIS has established itself as an indispensable measuring solution for characterizing all kinds of materials and for analyzing the reaction of prototypes, components and structures to mechanical loads.

Characterizing composite materials

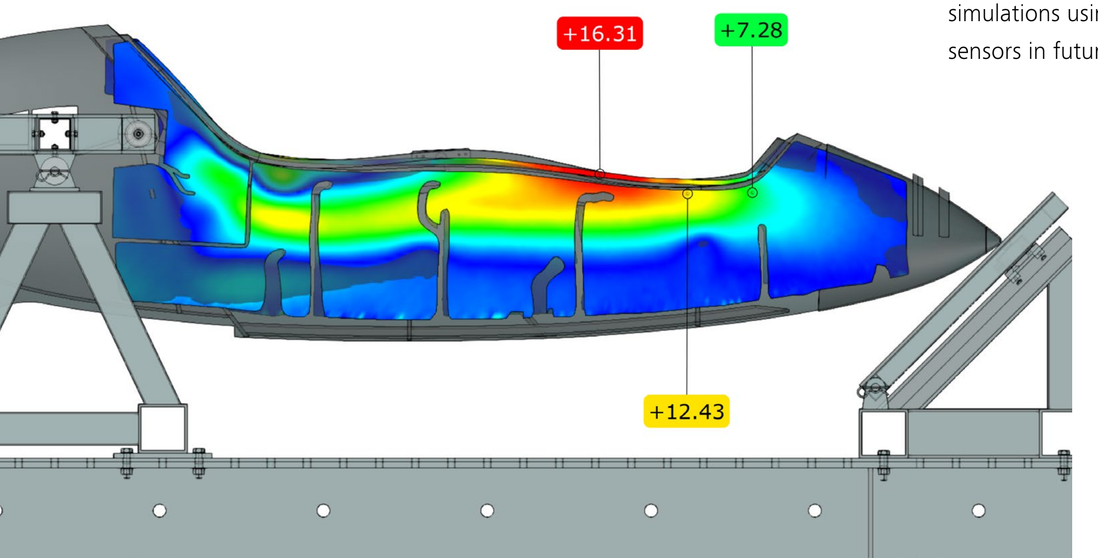
Utilizing several thousand measuring points on the surface of the coupon, ARAMIS allows for detailed analysis of the material, for example, of composites during tensile tests. As a result, conventional strain gauges are no longer necessary to a large extent. The full-field ARAMIS measurement captures the entire visible surface of the coupon with a simultaneously high spatial and temporal resolution.

Component and structure testing

ARAMIS reduces the time and costs of deformation measurements (airfoils, control surfaces, etc.), fuselage shell structural testing, vibration analyses and component testing (e.g., pressure and shear tests on panels for buckling analysis including simulation validation) and replaces LVDTs as well as accelerometers at the same time.

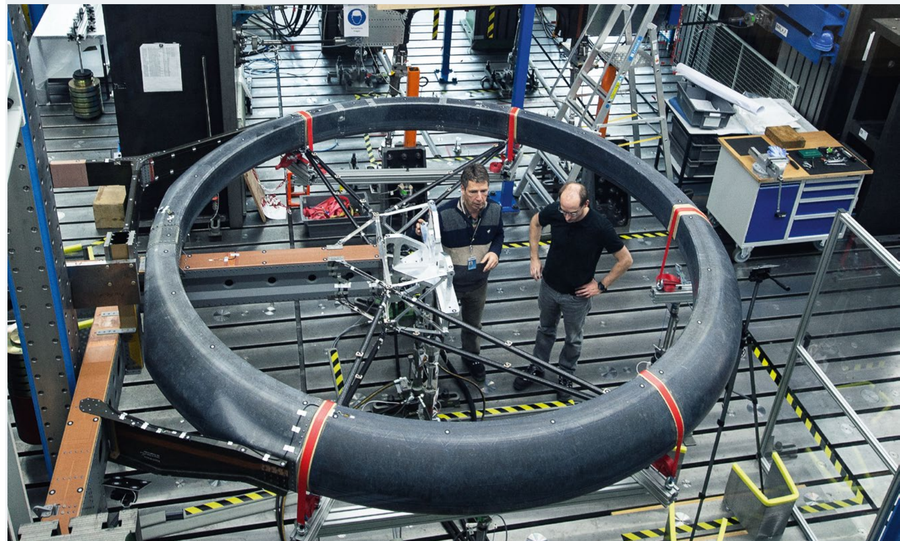
Validation of numerical simulation

Aside from new materials and propulsion concepts, hybrid testing consisting of physical and virtual tests plays an important role. ARAMIS provides valuable information to validate simulations using the measured data and to support virtual sensors in future.



In use at Airbus Helicopters

Airbus Helicopters utilize ARAMIS for prototype testing and the development of parts and structural components. Using ARAMIS, the helicopter manufacturer measures displacements in three dimensions with relatively little effort and in real time. The system is therefore also suitable for limit value monitoring. If an unforeseen event occurs, the test can be switched off in good time. This considerably reduces the risk of unintentionally destroying expensive specimens. Via a digital interface, ARAMIS was synchronized with the data streaming of the GeMCoS measuring and control system.



AUTOMOTIVE

Productivity Boost

for the mobility of tomorrow

In e-mobility, lightweight construction or classic disciplines of vehicle development: With 3D measuring data from ARAMIS, OEMs and service providers can reliably meet the stringent requirements regarding safety, function and service life.

Developing new energy vehicles (NEV)

Batteries are the power source for the next generation of vehicles. ARAMIS provides valuable support in the development of batteries for electromobility, including material characterization and the digital assembly and positioning of individual battery modules. Moreover, the system is suitable for vibration and stiffness analyses as well as for analyzing the thermal load behavior of battery cells and modules during the charging process (battery bloat, swelling). Along with the electrical influences on the battery (e. g. overcharging, short circuit, deep discharge) and the resulting thermal expansions, the focus of development is also on testing the crash safety of the battery systems. In this field, the ARAMIS measuring system is used to assess the deformation behavior of battery housings in impact tests (e. g. drop tests, pole impact tests).

Determining the properties of sheet metal materials

Material characteristics are important parameters for the design of parts and their simulation. Based on highly accurate 3D measuring data, ARAMIS enables the determination of material properties, such as the forming limit curve (FLC) in accordance with ISO 12004 or the biaxial flow curve in accordance with ISO 16808 as well as the characteristics that are determined through the tensile test (Young's modulus, yield point Rp 0.2, tensile strength Rm, uniform strain, failure strain, R-value, N-value).

Root cause analysis

The reduction of disturbing noises, such as squeaking or creaking, due to vibrations is a main requirement in modern automotive engineering. With the help of the comprehensive ARAMIS motion analysis, unwanted part behavior is quickly located and disturbing noises eliminated.

Crash and impact testing

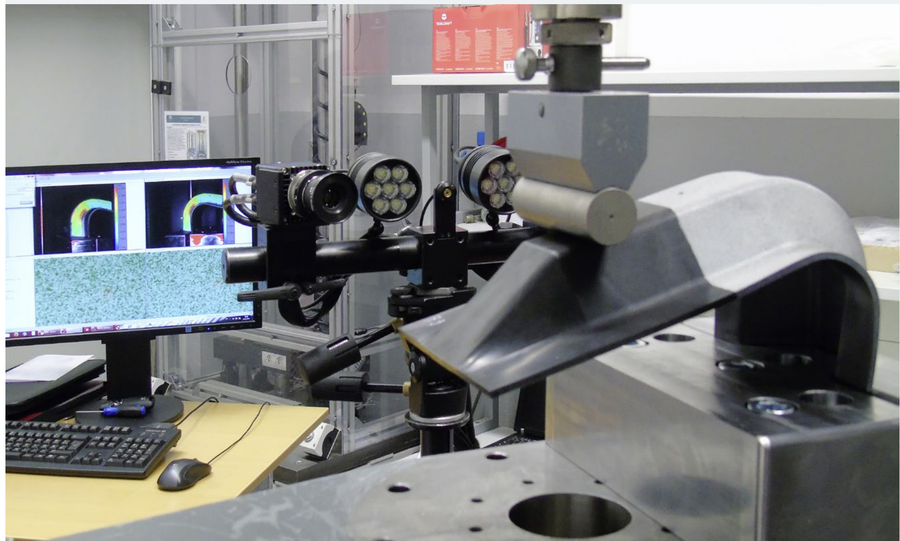
By means of measuring data obtained from sled tests, motions of components, such as seats and crash test dummies, can be tracked in six degrees of freedom (6DoF). Using ARAMIS, the rotatory and translatory movements of a dummy's head can be measured as well as the movement and rotation of the upper body, the impact speed of the head, when it hits the headrest, and leg movements.

Other fields of application

- Doors, hood and trunk lid closures testing
- Vibration and oscillation analyses
- Testing on chassis, wheels and engine test benches
- Testing on manifolds and decoupling elements
- Airbag tests
- Wind tunnel tests
- Passive safety analyses
- Climate chamber tests

In use at the Institute of Lightweight Structures of the Chemnitz University of Technology

Using optical 3D metrology, researchers at Chemnitz University of Technology, Germany, are able to precisely describe material properties, optimize manufacturing processes and develop a custom-fit lightweight component for every industrial application. Beneficiary of this is, among others, a German automobile manufacturer: Taking the upper class model as an example, the researchers have designed a technology demonstrator for a roof bow made of fiber-reinforced thermoplastics, which is suitable for cost-effective, large-scale series production in contrast to the thermoset series component.

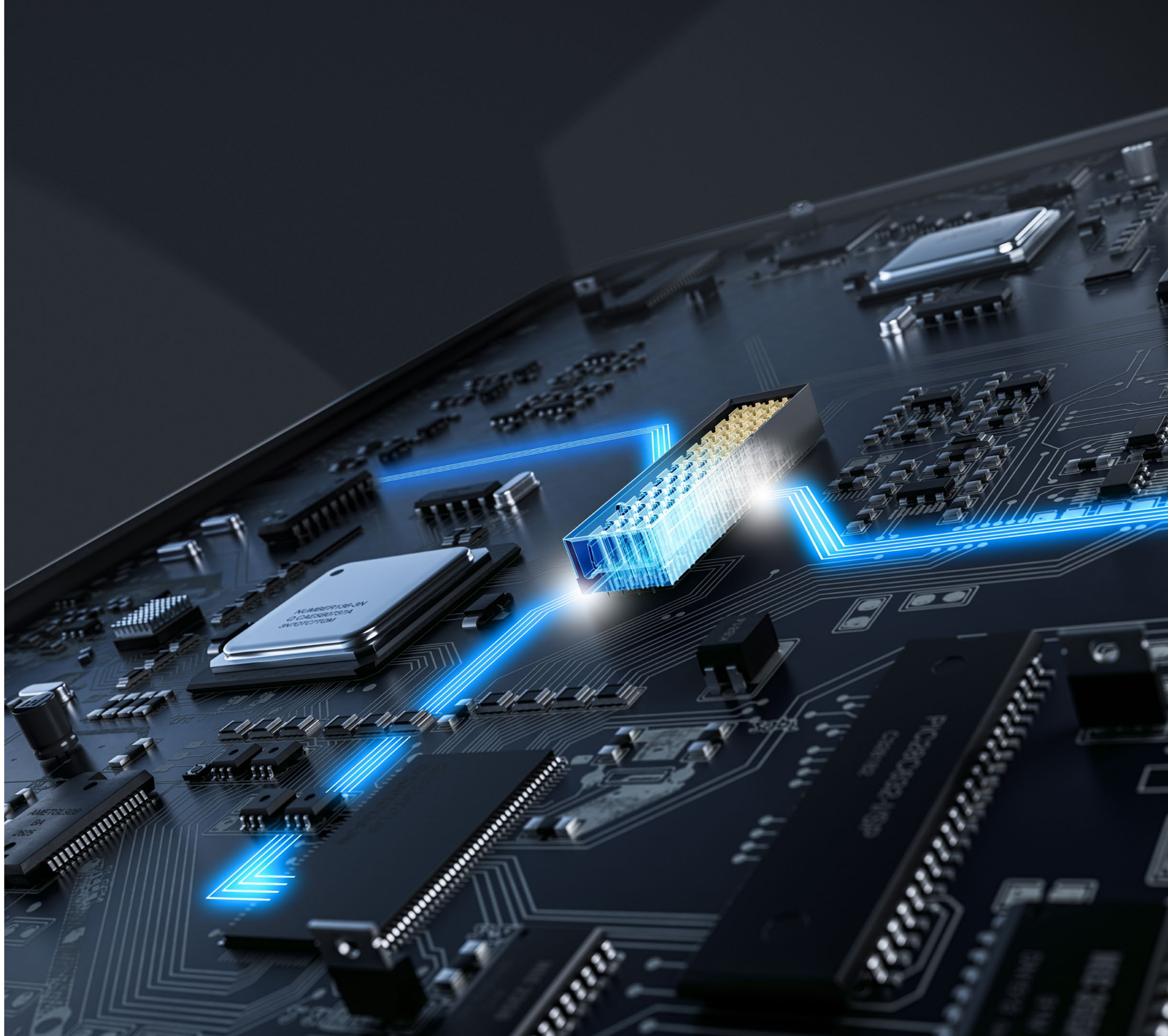


ELECTRONICS AND ELECTRICAL ENGINEERING

High Tech

for innovative products

ARAMIS provides the competitive advantage that companies need in this fast-paced industry: more efficiency in product development combined with essential expert knowledge regarding materials and parts.



Characterization of electronic materials

The base materials and components for circuit boards and computer chips are very sensitive. For this reason, tactile measurements are not possible. Only with a system using non-contact measuring methods, such as ARAMIS, thousands of measuring points on the material surface can be analyzed for strain and displacements. The so-called coefficient of thermal elongation is particularly important for the semiconductor manufacturing process and the service life of circuit boards. ARAMIS allows for the determination of the coefficient of thermal elongation (CTE) and simultaneously analyzes the thermal distortion of chips and semiconductor parts with only one measuring system.

Thermomechanical testing

With ARAMIS, the high cycle fatigue strength and fatigue endurance limit of joints and soldered connections can be analyzed. The curvature of the bond wires as well as the change in distance to the substrate below are tracked while an electrical load is applied. During this process, the 3D deformation can be correlated with the temperature. Utilizing the function extensions of the Thermographic Mapping App, the software can link the measured 3D object coordinate with the corresponding temperature value.

Distortion analysis

Soldered joints between microchips and circuit boards fail mainly due to fatigue failure as a result of alternating thermal stress. ARAMIS allows for full-field evaluation of the distortion of chips and the resulting stress on soldering joints through thermally induced strain.

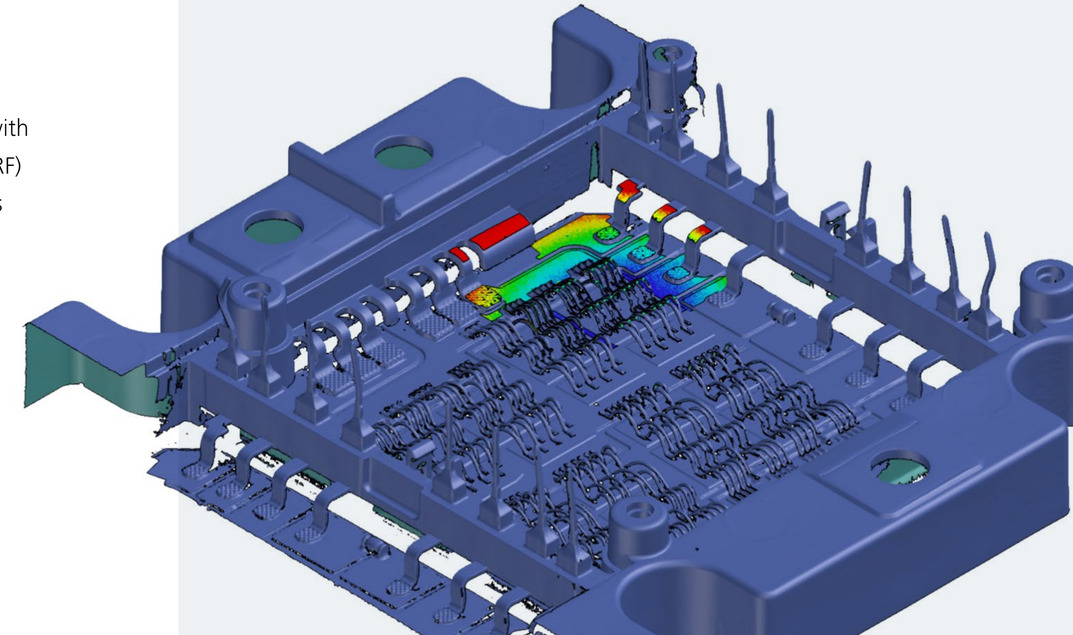
Aside from thermal distortion, ARAMIS also enables the full-field measurement and evaluation of mechanical distortion. Mechanical distortion can be caused, for example, by the tightening of screws during board assembly.

Other applications

- Peel tests for chips on circuit boards
- Pull-out tests for electrical connectors
- Vibration analysis of electrical assemblies and parts with determination of the frequency response function (FRF) and visualization of the operational deflection shapes

IGBT assembly testing

Using ARAMIS, researchers at a German technical university have analyzed the 3D deformation and temperature behavior of an IGBT assembly from the field of power electronics under a pulsed electrical load. They were particularly interested in the movement of bond wires which occurs in the micrometer range. ARAMIS was able to detect the movements as required. The results were documented in clear and well-structured reports.

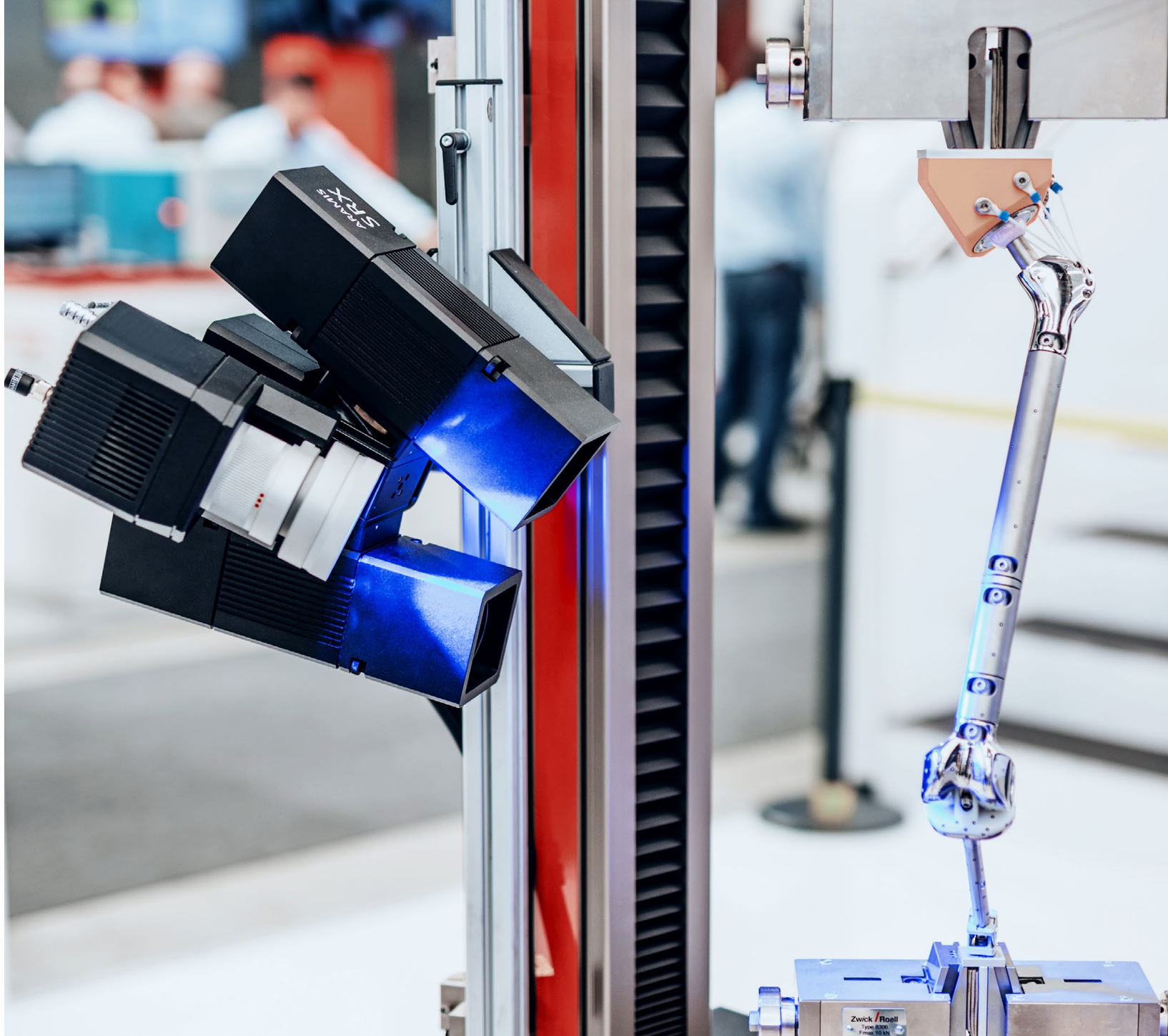


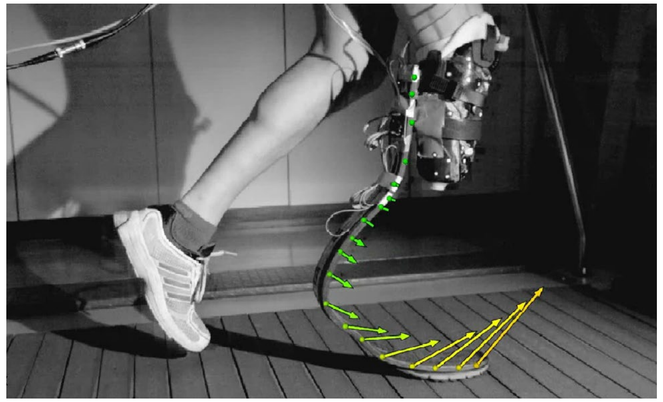
MEDICAL TECHNOLOGY

Health and Safety

as the focal point

Optical 3D metrology provides valuable insights for research on new materials and the development of orthopedic implants and sports products.





Testing of orthopedic implants

The applications of ARAMIS in this area range from cyclic compression tests on hip joint implants to forecast the service life expectancy of the implant, to validating numerical simulations of fixation bars for the treatment of mandibular fractures, to motion analyses on disc implants. When using ARAMIS, the effort and time for specimen preparation is reduced compared to conventional displacement sensors. In addition, the system offers automation options for measurements and evaluations.

Metrological analysis of surgical procedures

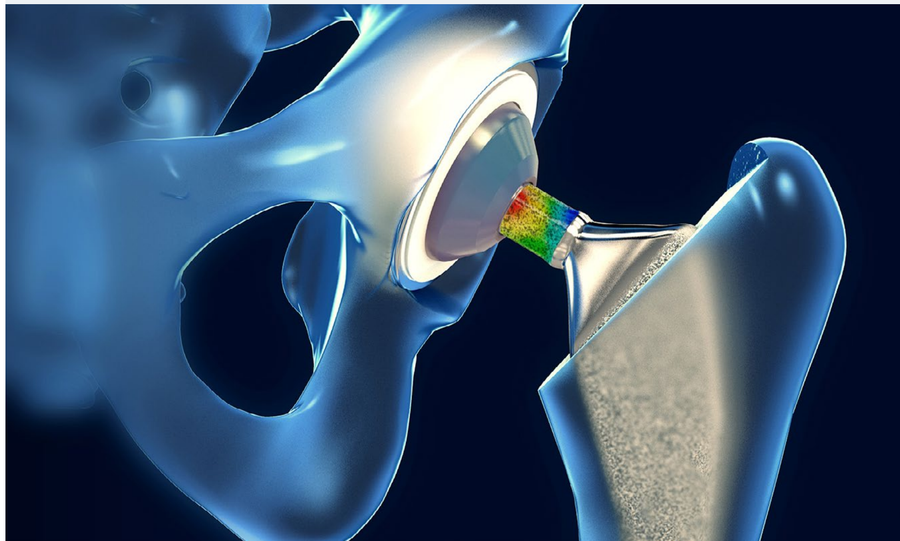
ARAMIS is further utilized to improve surgical procedures and provides, for example, metrological insights regarding the stress applied to bone material by different fixation methods for shoulder dislocations (Latarjet procedure). The system also enables the comparison of different tibia nail systems for the treatment of tibia fractures with respect to micro motion to ensure an optimum degree of movement between the fragments for the healing process of the fracture.

Dynamic analyses of prostheses for determining the high cycle fatigue strength

During strain, load and fatigue tests, the mechanical properties of biomaterials and their behavior under load are analyzed. Companies use ARAMIS, for example, for 3D deformation, 3D motion and particularly for 6DoF analyses of implants, prostheses and orthoses. Motion sequences as well as the interaction with bones and tissue are thoroughly recorded in the course of the 3D surface measurement and evaluated. During the Woehler fatigue test (high cycle fatigue test), ARAMIS supports researchers in making precise conclusions on the finite-life fatigue strength and fatigue limit of a material or product. The optical 3D sensors provide highly accurate measuring data for the computation of the prostheses' service life.

In use at LimaCorporate

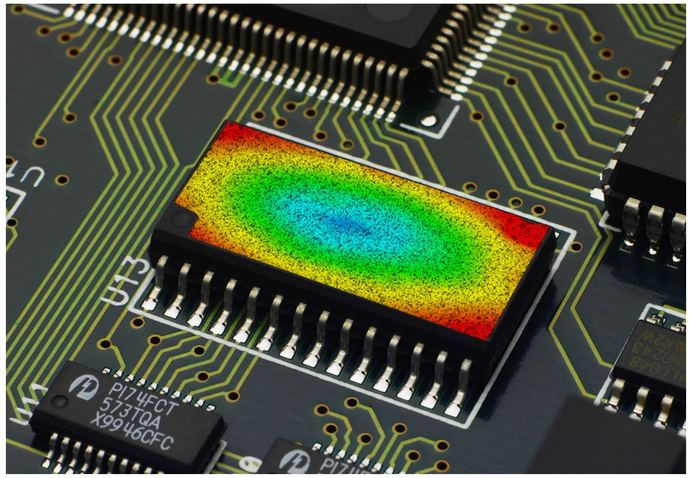
With the introduction of the optical 3D system ARAMIS, the manufacturer of orthopedic implants was able to reduce the time for specimen preparation from days to mere minutes. Physical sensors, such as accelerometers and strain gauges, are no longer required. By connecting the ARAMIS system with the testing machine, measuring data are captured synchronously and the measuring procedure has been completely automated. The permanent presence of a person at the test bench is no longer required. Instead, other laboratory tasks can be performed in parallel. This leads to a significant increase in efficiency.

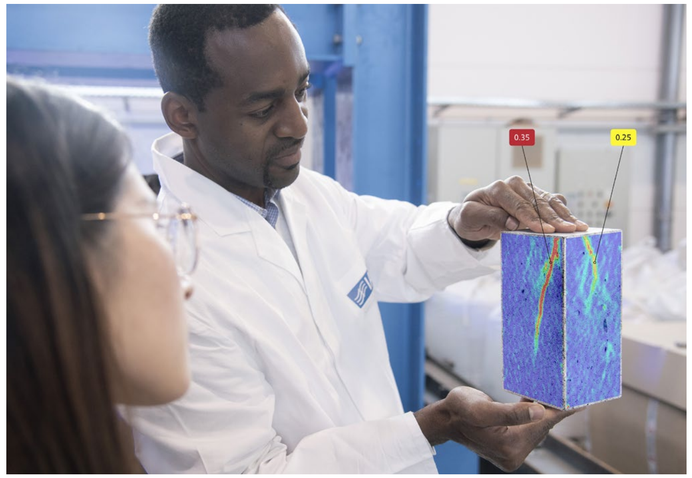


Customer Testimonials

The optical measurement system ZEISS ARAMIS is a cutting-edge technology designed to meet the needs of various industry sectors and research institutions in the field of development, prototyping and material testing. With ZEISS ARAMIS, you can trust that your measurements will be precise and comprehensive, to make your research successful.

Here are some examples of how customers benefit from ZEISS ARAMIS.





ZEISS Industrial Quality Solutions

ZEISS Industrial Quality Solutions is a leading manufacturer of multi-dimensional measurement technology solutions. These include coordinate measuring machines, optical and multisensor systems, microscopy systems for industrial quality assurance as well as metrology software for the automotive, aircraft, mechanical engineering, plastics and medical technology industries. Innovative technologies such as 3D X-ray measurement for quality assurance complete the portfolio.

In addition, ZEISS Industrial Quality Solutions offers a broad global spectrum of customer services with ZEISS Quality Excellence Centers close to its customers. The company is headquartered in Oberkochen. Production and development sites outside Germany are located in Minneapolis, USA, Shanghai, China and Bangalore, India.

ZEISS Industrial Quality Solutions is part of the Industrial Quality & Research segment.

Your holistic technology partner

Numerous services and training courses are available to support you in your daily use of 3D measurement technology. Training courses and webinars help you to extend your knowledge about using the software and get to know more application fields for the measuring systems.

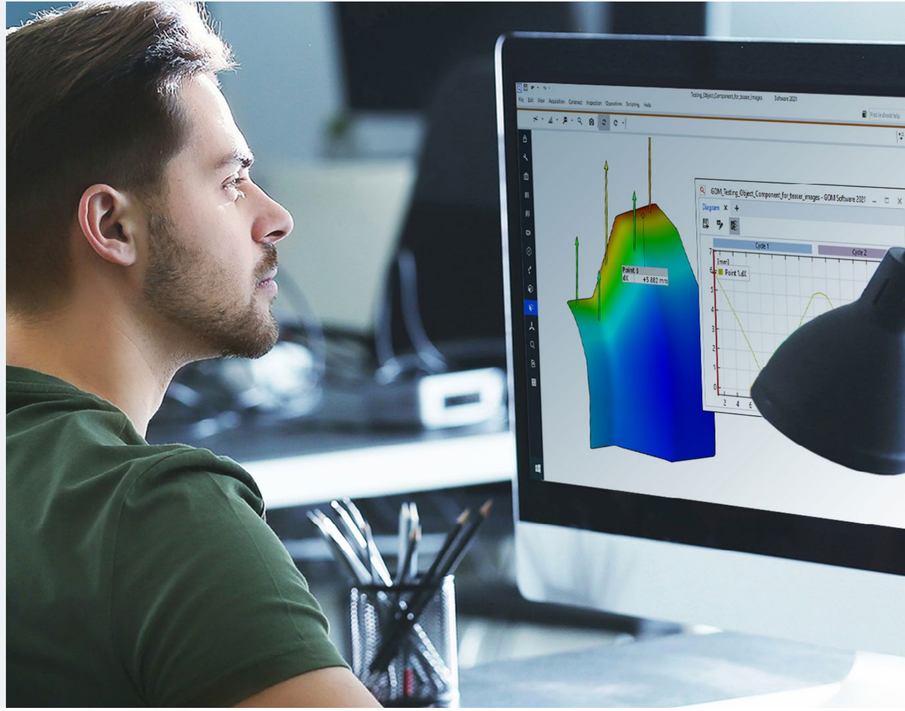
ZEISS Quality Suite supports you with instructions, tutorials and provides answers to frequently asked questions. Moreover, the user forum offers a platform for mutual exchange and support.

At conferences and application-based workshops, webinars and digital demos, ZEISS directly shares process and measurement technology know-how. In addition, contractual support and services for all measuring solutions are available.

Training

Our training centers offer training and eLearning courses for all levels of expertise. The training courses follow an internationally standardized concept and are implemented by our certified partners in the corresponding national language. In addition to online training courses and scheduled courses in our training centers, customer-specific training courses on site are also available on request.

Learn more



Support and service

ZEISS provides support and services to assist you quickly and reliably whenever needed. These are based on the following three pillars: Remote Assistance, Services and ZEISS Metrology Care.

Learn more

Did ARAMIS Get Your Attention?

Contact us for a free demonstration – on site or online.

Contact us

Certified
Metrology Partner

EN_Brochure ARAMIS Digital Version CZ-03/2024
Subject to change in design and scope of delivery and as a result of ongoing technical development.