RoboVib® structural test station

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Automated experimental modal testing
Product brochure

Automated experimental modal analysis to save time and cost

By mounting a 3D Scanning Vibrometer to a multi-axis industrial robot, RoboVib removes many of the limitations of traditional contact transducer methods. RoboVib is engineered for measuring anything – from complex components up to complete vehicle bodies. With RoboVib you can automatically acquire and record the data necessary for a modal analysis which can be indispensable for the development of new products.

This technological symbiosis drastically reduces test times for experimental modal analysis (EMA): from weeks to days and from days to hours. Deriving the measurement points from Finite Element (FE) Models facilitates Model updating. Due to the increased productivity, test fields and prototypes are used more efficiently, the results are faster available.

Push the boundaries free from limitations

Structure-borne noise measurements using laser-Doppler vibrometry are a perfect solution to optimize the noise and vibration characteristics of a product in development. This laser technology can increase the measurement point density without influencing the structure or its vibration characteristics, while simultaneously reducing the testing time. High fidelity test data measured in the coordinate system and at the nodal points of the FE mesh are the output of RoboVib.

And it is the perfect input data for modal analysis and subsequent model updating process. The datasets can be used inherently for acoustic simulations due to their spatial density and fidelity.

Fast and precise laser scanning

By using a laser as the vibration probe, RoboVib takes data with zero mass loading, eliminating the inaccuracies and complexities associated with mounting and removing traditional contact sensors. At the same time, the number of measurement points is not limited by the sensor size and the number of available measurement channels. This allows a higher density of measurement points and a model validation at higher frequencies. The measurement points can be determined using the Scanning Vibrometer software or imported directly from the FE application. The setup is simple and the measurement sequence is fast. High resolution test data can be taken in a fraction of the time needed for traditional contact transducer methods.
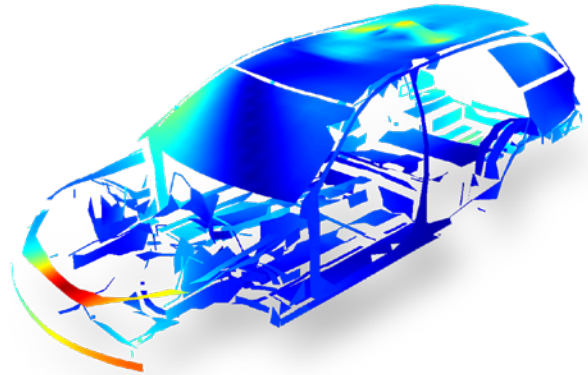
Save time - increase quality

The RoboVib system can be run unattended, allowing measurements to be scheduled day or night. The test set-up is completed during standard working hours, the measurement is started and the results are ready for analysis the next day.

Testing time for structural analysis of complex shaped objects like complete vehicles is drastically reduced from weeks to only a few hours and is conducted automatically overnight.

Improving vibration testing

The goal	RoboVib®'s contribution
• Integrate all data into one CAE data workflow	Supplies interfaces for incorporating FE geometry, external sensor test data, and modal analysis
• Automate recurring tasks	Computer driven robot arm allows unattended measurements and eliminates sensor mounting
• Reduce error sources	Eliminates interpolation and errors in point definition (Euler angle determination), cabling, mounting, and calibration
• Reuse test setups for similar tasks	Saves test setups. Can be used for similar object sizes and shapes

Flexibility through robots

Using the PSV QTec 3D Scanning Vibrometer, vibration data for deflection shape analysis of the visible part of the object are acquired segment by segment. To measure a car body or any complex shaped object, the scanning heads are repositioned several times to cover all views. Each of the partial measurements or views is then stitched together to make a complete picture of the car body.

The RoboVib Structural Test Station uses an industrial robot to automate the repositioning of the heads. Using six rotation axes, all spatial degrees-of-freedom can be accessed by the robot. For an extended measurement volume an additional linear axis is used or a second robot measures in parallel to double productivity. By using this unique combination of technologies, the degree of automation can be dramatically increased leading to significant time and cost savings.
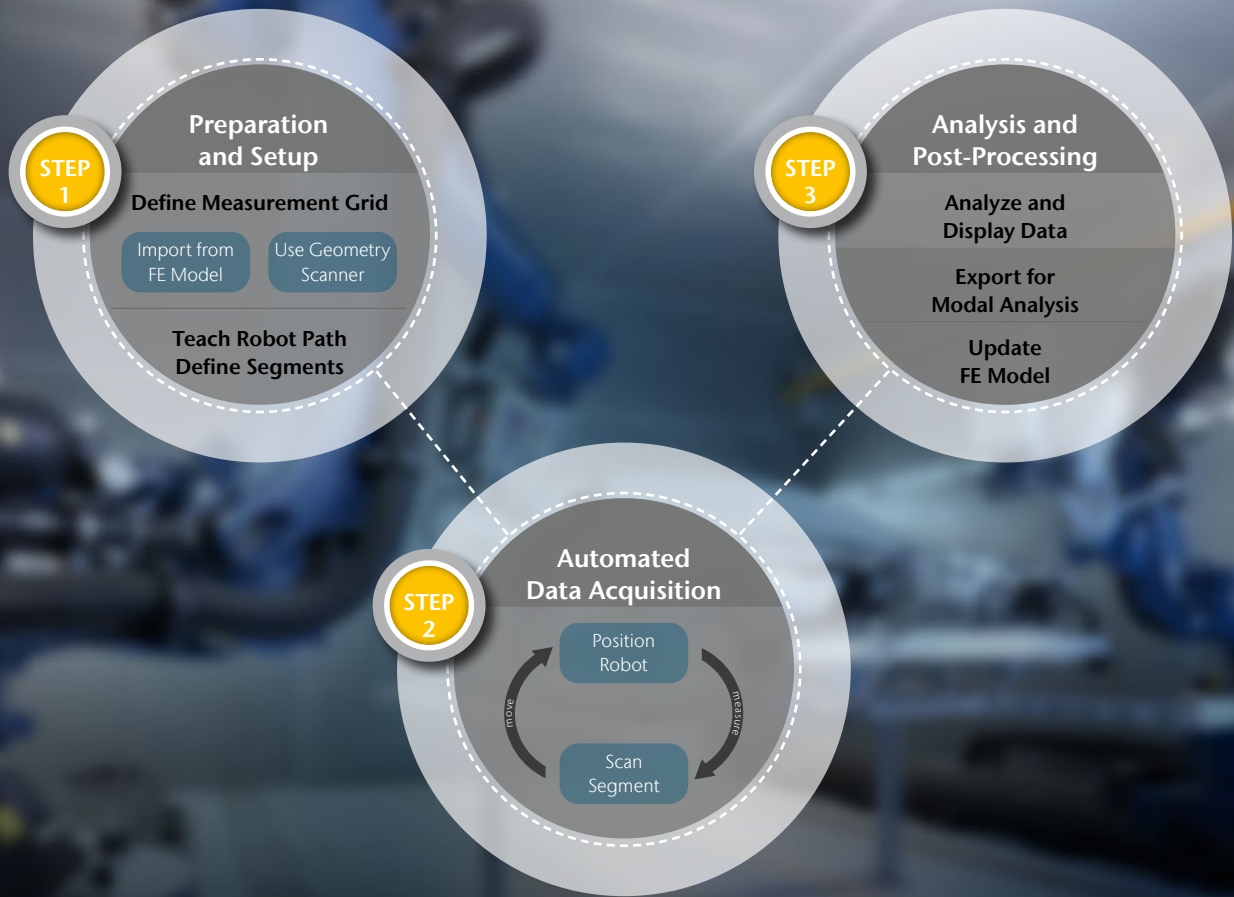
Customized to your needs

A RoboVib Structural Test Station can be tailored to your requirements and measurement tasks. The basic setup comprises a PSV QTec 3D Scanning Vibrometer and an industrial robot. Two powerful software packages – PSV Software and the RoboVib Software – assure precise control of the data acquisition process and the robot(s) positioning.

QTec® performance

The patented QTec® multi-path interferometer technology boosts the signal quality of laser vibrometer decisively. By eliminating the influence of rough surfaces on the signal quality it assures high-fidelity measurement data on any surface and reduces testing time significantly.
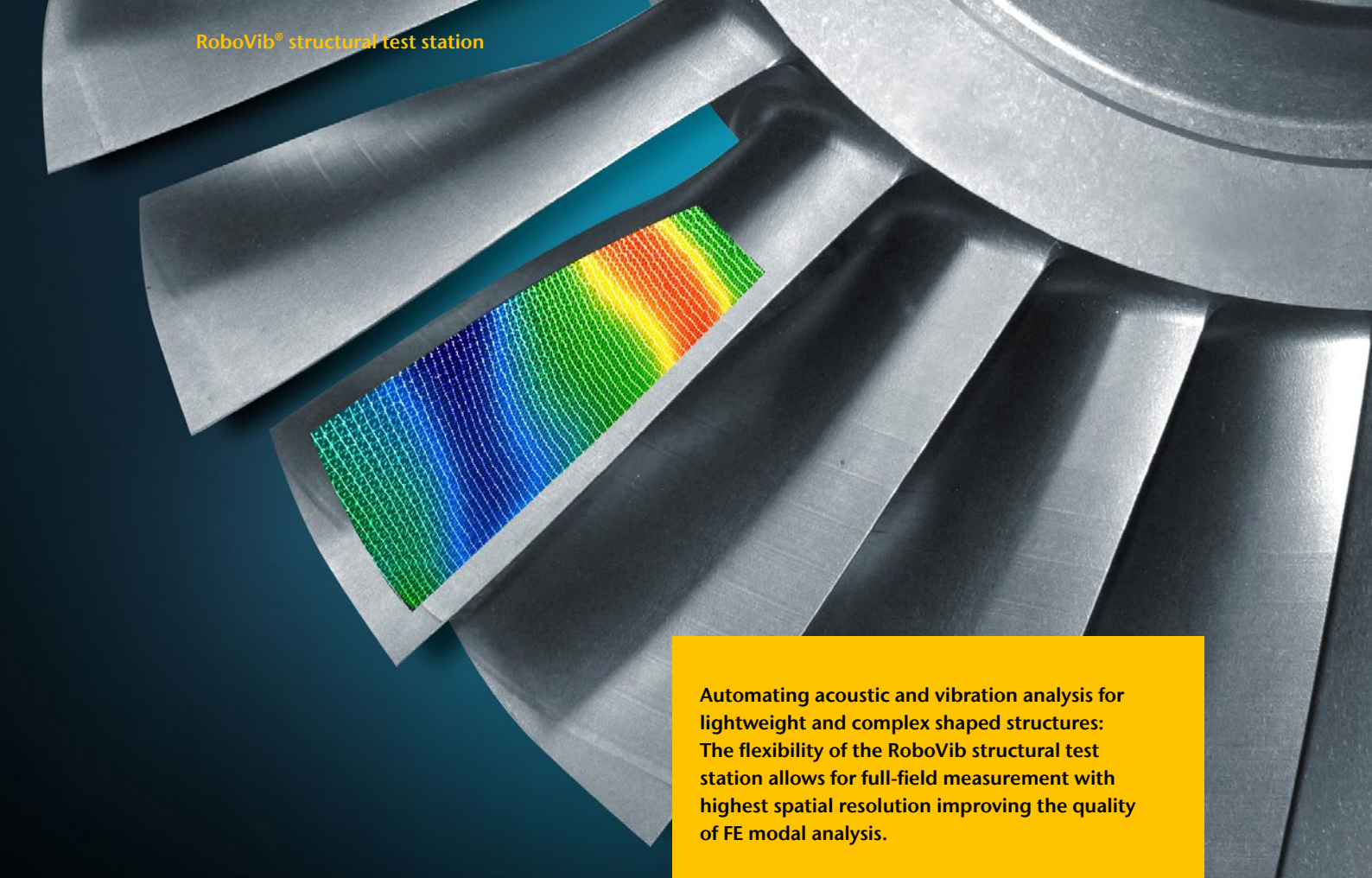
The RoboVib® workflow

STEP 1

Preparation and Setup

Define Measurement Grid

Import from FE Model | Use Geometry Scanner

Teach Robot Path Define Segments

STEP 2

Automated Data Acquisition

Position Robot

move | measure

Scan Segment

STEP 3

Analysis and Post-Processing

Analyze and Display Data

Export for Modal Analysis

Update FE Model

The RoboVib® workflow

Step 1 starts with the setup using a measurement grid from the FE model. Step 2 comprises the fully automated test cycle, moving the laser scanning heads from position to position scanning each segment. Every measurement point directly refers to a FE nodal point. The segmental data is stichted together, resulting in a common data set based on the FE nodal information. No human interaction is necessary. Thus Step 2 can be performed unattended and during off-hours.

In Step 3, the test data is ready for analysis. Animated deflection shapes and the full frequency and phase information is presented for analysis and for export to modal analysis software or to further post-processing.

Automating acoustic and vibration analysis for lightweight and complex shaped structures: The flexibility of the RoboVib structural test station allows for full-field measurement with highest spatial resolution improving the quality of FE modal analysis.

Highlights

Reduced test time

- Cut down testing time
  Large component test in hours instead of days, also over night

- Store measurement settings
  Reuse measurement positions for similar objects

- Import geometry data
  Results displayed in object's coordinate system

- Automate test procedure
  Run tests unattended and during off-times

Ultimate precision

- See more details
  High point density for better FE model update

- Eliminate mass loading
  Non-contact laser measurement

- Export test data on nodal points
  No interpolation required

- Easy maintenance
  Only 3 sensors are calibrated every two years

Increased freedom

- Scan geometries
  Unveil deviations between model and sample geometry

- Integrate external data
  Include accelerometer measurements for hidden points

- Use unlimited measurement channels
  Allows higher density of measurement points and model validation at higher frequencies

Key product features

Components

- KUKA robot suitable for the required working space
- KUKA linear axis (optional)
- KUKA turntable (optional)
- PSV QTec 3D Scanning Vibrometer
- RoboVib Software

Performance

- Frequency bandwidth: 25 MHz in 1D-mode, 5 MHz in 3D-mode
- Velocity range up to 30 m/s
- Resolution down to 0.005 µm $s^{-1}/\sqrt{Hz}$

Data handling

- Target data: frequency response functions in Cartesian coordinates in the coordinate system of the test object
- MIMO capability (up to 8 reference channels, and 4 uncorrelated signal generator channels), principal component analysis
- Import and export of geometry and vibration data in common file formats including ASAM ODS

  ◇ ASAM
    MEMBER

- Open data interface: Polytec File Access (enables data access utilizing Visual Basic®, C++ or MATLAB®)

Start saving test time today!

Make use of the RoboVib benefits in the Polytec Test Centers in Waldbronn, Germany, Dexter, MI, USA and Yokohama, Japan.

More Info

Visit www.robovib.net for more information, applications and demo videos about the RoboVib Structural Test Station and the PSV QTec 3D Scanning Vibrometer.

In addition, Polytec product specialists are available by phone and email to help configure the perfect system for your application.
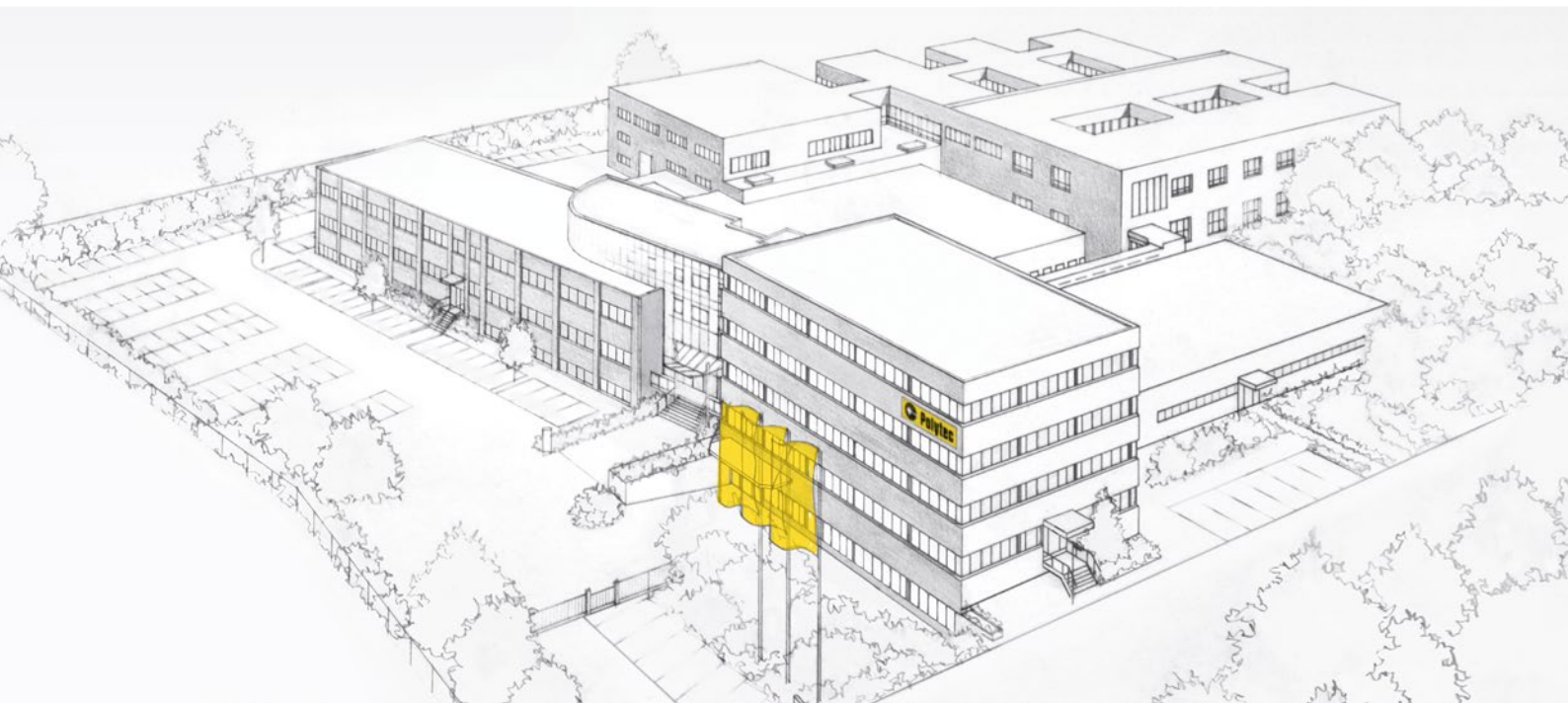
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