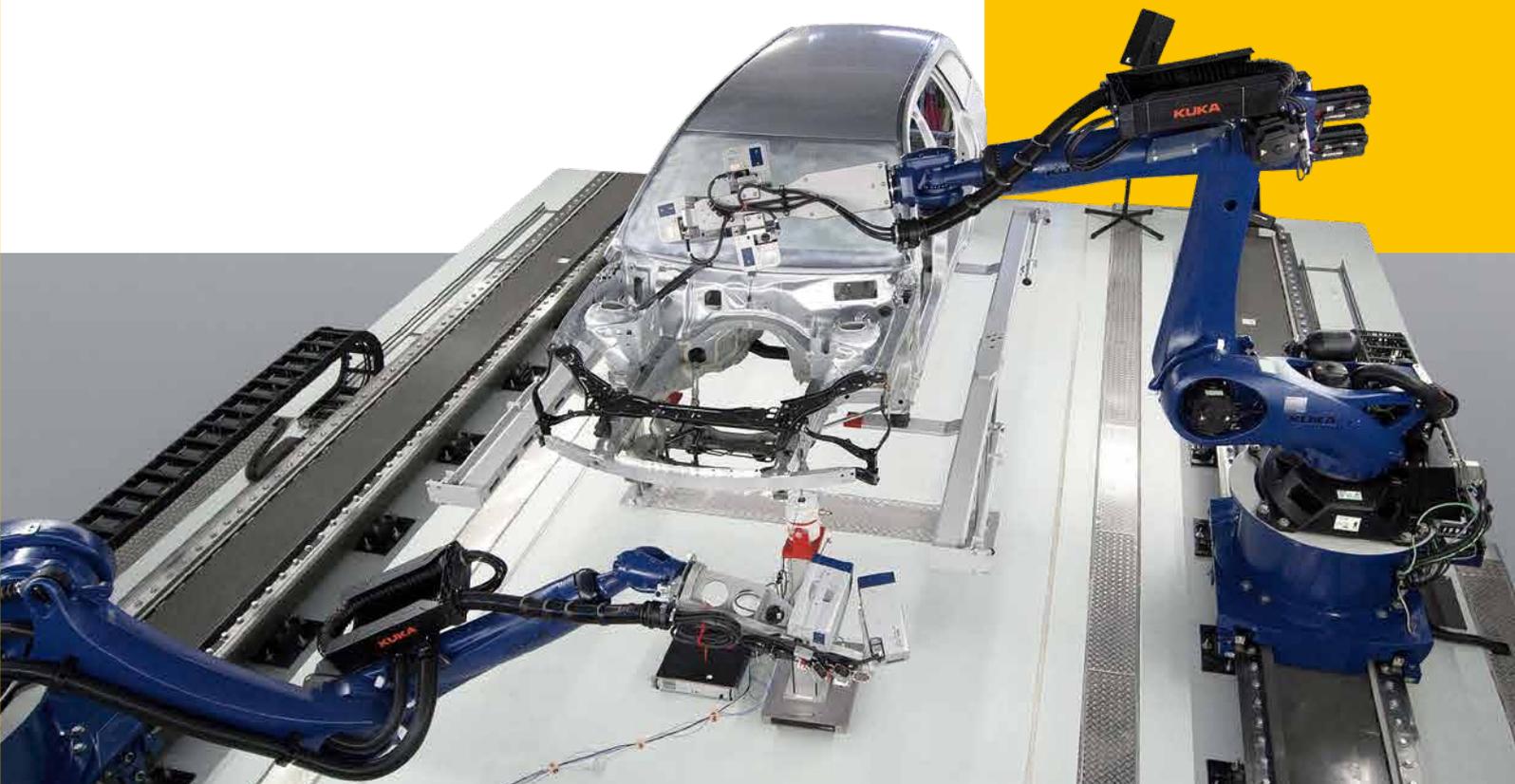


RoboVib® Structural Test Station

Automated Experimental Modal Testing



Reduce Test Time and Costs – Gain Flexibility



RoboVib® removes many of the limitations of traditional contact transducer methods. By mounting a 3D Scanning Vibrometer to a multi-axis industrial robot, RoboVib® is engineered to be a stable, auto-configurable 3D vibration measurement station for whole body vibration mapping of complex-shaped objects. This unique combination of productive technologies can reduce test times for experimental modal analysis (EMA) from weeks to days and from days to hours. The points to be measured can be derived from Finite Element (FE) Models, thus facilitating 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 inherently can be used for acoustic simulations due to their spatial density and fidelity.

Fast and Accurate

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 in the next day.

Flexibility Through Robots

Using the PSV-500-3D Scanning Vibrometer, the deflection shape of the visible part of the object under test is 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 a seventh 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.

The RoboVib® Workflow

Just three steps lead to impressive results (Fig. 1). In Step 1 the setup is done using a measurement grid derived from the FE model.

Improving Vibration Testing

The Goal	RoboVib®'s Contribution
<ul style="list-style-type: none"> Integrate all data into one CAE data workflow 	Supplies interfaces for incorporating FE geometry, FE nodal points, external sensor test data, and modal analysis
<ul style="list-style-type: none"> Automate recurring tasks 	Computer driven robot arm allows unattended measurements and eliminates sensor mounting
<ul style="list-style-type: none"> Reduce error sources 	Eliminates errors in point definition (Euler angle determination), cabling, mounting, and calibration
<ul style="list-style-type: none"> Reuse test setups for similar tasks 	Saves test setups. Can be used for similar object sizes and shapes

Step 2 comprises the fully automated test cycle, moving the laser scanning heads from position to position, scanning the segments, and combining the test data with a model based on the nodal information from the FE data set. 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.

Customized to Your Needs

A RoboVib® Structural Test Station can be tailored to your requirements and measurement tasks. The basic setup comprises a PSV-500-3D 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.

How it Works: The Principle of Laser-Doppler Vibrometers

The laser-Doppler vibrometer is a very precise, optical transducer used for determining the vibration velocity and displacement at a point by sensing the frequency shift of back scattered light from a moving surface. For more information please view our vibrometer and RoboVib® videos on www.polytec.com/video

More Info: www.robovib.us

Useful Features Convincing Benefits

- **Fast**
Large component test in hours instead of days
- **High point density**
Better FE model update
- **Unlimited measurement channels**
Eliminates dummy masses used for finite number of accelerometers
- **Non-contact**
Eliminates mass loading
- **Integrated geometry scan**
Suitable for benchmarking
- **Stored measurement setup**
Reuse measurement positions for similar objects
- **Geometry data import**
Results displayed in object's coordinate system
- **Test data export on nodal points**
No interpolation required
- **Integration of external data**
Include accelerometer measurements for hidden points
- **Automated test procedure**
Run tests unattended and during off-times
- **Simple, stable calibration**
Only 3 sensors are calibrated every two years

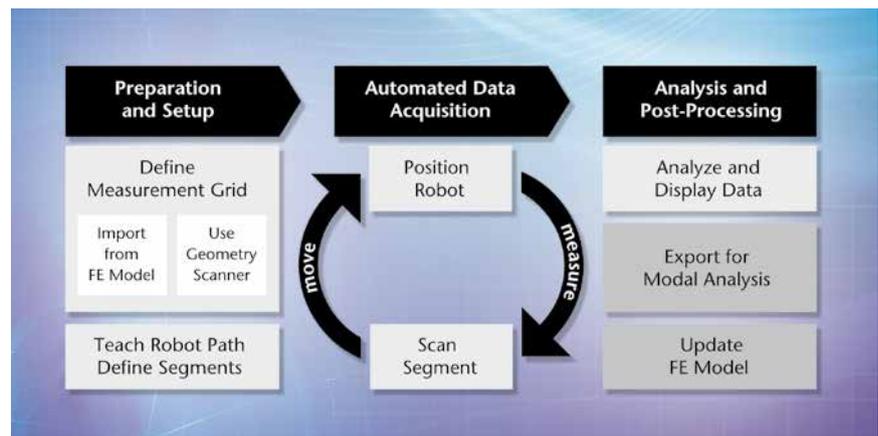


Fig. 1: The RoboVib® Workflow.



Fig. 2: Measurement setup showing an operational deflection shape (ODS) of a car body based on 1094 measurement points (3282 FRFs). Total measurement time: 2.5 hours.

Technical Data

Industrial Robot

(The following table gives typical examples for test object size and measurement coverage)

Robot	Linear Axis	Max. Object Size (L x D x H)	Measurement
KUKA KR 120 R3500K Prime	KL1500 (5.0 m)	6.0 m x 1.1 m x 2.2 m	of the front, top and side (approx. half of a car body)

Various configurations are available to fit your specific needs.

PSV-500-3D Scanning Vibrometer

Frequency range	0 kHz ... 100 kHz (1 MHz optional)
Velocity range	0.01 $\mu\text{m/s}$... 10 m/s
Laser properties	Class II He-Ne laser, 633 nm (visible red laser beam), 1 mW per sensor
Reference channels	8 (e.g. 4x driving point, 4x input force for MIMO)
Output channels	4, uncorrelated (signal generator), suitable for MIMO measurements
Target data	<ul style="list-style-type: none"> Vibration components in Cartesian coordinates in the coordinate system of the test object Calculation of the transfer functions For MIMO: principal component analysis
Data representation	<ul style="list-style-type: none"> Animated representation of the vibration data as deflection from zero position and color code; provides a three-dimensional impression of the vibration 2D or 3D representation of each vibration component (X, Y, Z)
Data export	<ul style="list-style-type: none"> Windows® Automation Interface: Polytec File Access (enables data access utilizing Visual Basic®, C++ or MATLAB®) Export of geometry data, spectra, time signals and deflection shapes as Universal File (UFF), STL, ASAM ODS*, ME'scope* file Export of animated 2-D and 3-D models and profiles as an AVI or animated GIF file
Data import	<ul style="list-style-type: none"> Import of geometry data from UFF, STL, ASAM ODS or ME'scope files Import of vibration measurement data as UFF or ME'scope files

*optional / as an option

More Info

Visit www.robovib.us for complete information, application notes, demo videos and current specifications about the RoboVib® Structural Test Station and the PSV-500-3D Scanning Vibrometer. In addition, Polytec product specialists are available by phone and email to help configure the perfect system for your application. Please see our list of office locations and contact details.

Start saving test time today!

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



Polytec GmbH (Germany)

Polytec-Platz 1-7
76337 Waldbronn
Tel. +49 7243 604-0
info@polytec.de

Polytec France S.A.S.

Bâtiment Orion – 1^{er} étage
39, rue Louveau
92320 Châtillon
Tel. +33 1 496569-00
info@polytec.fr

Polytec Ltd.

(Great Britain)
Lambda House, Batford Mill
Harpenden, Herts AL5 5BZ
Tel. +44 1582 711670
info@polytec-ltd.co.uk

Polytec Japan

Arena Tower, 13th floor
3-1-9, Shinyokohama
Kohoku-ku, Yokohama-shi
Kanagawa, 222-0033
Tel. +81 45 478-6980
info@polytec.co.jp

Polytec, Inc. (USA)

North American Headquarters
16400 Bake Parkway
Suites 150 & 200
Irvine, CA 92618
Tel. +1 949 943-3033
info@polytec.com

Central Office
1046 Baker Road
Dexter, MI 48130
Tel. +1 734 253-9428

East Coast Office
25 South Street, Suite A
Hopkinton, MA 01748
Tel. +1 508 417-1040

Polytec South-East Asia Pte Ltd
Blk 4010 Ang Mo Kio Ave 10
#06-06 TechPlace 1
Singapore 569626
Tel. +65 6451 0886
info@polytec-sea.com