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Polytec

InFocus

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Non-Contact Optical Metrology in Industrial Production

MORE INFO:
www.industrial-test.net

Eric Winkler

Dr. Hans-Lothar Pasch

Dear Readers,

Our customers have proven the value of Polytec's optical measuring systems in numerous research and development projects with outstanding results. The advantages of these systems compared to contact sensor systems are widely appreciated. Often, a contact-free method is the only way to make the required measurement; but, frequently, it is also an easier approach and one that is more cost-effective overall.

In addition to conventional R&D applications, our optical sensors are frequently used for production monitoring. For example, our vibrometers can be used to evaluate the acoustic signature (quality) of washing machine drives in production lines. Worldwide, our velocimeters are the leading technology for length and speed measurement of web materials, continuous castings and extrusions, such as in steel mills or in the extrusion of metals and plastics. Our optical 3-D surface measurement systems are used to improve the efficiency of in-line characterization and evaluation of functional surfaces.

In the future, industrial quality assurance will become even more important to manufacturers. In this issue, we have highlighted the latest Polytec news and also provided some selected application examples related to this topic.

We hope you will enjoy reading the articles and learn how Polytec sensors can help improve industrial quality control today and tomorrow!

Eric Winkler
Vice President
Optical Measurement Systems

Dr. Hans-Lothar Pasch
Managing Director
Polytec GmbH

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Polytec Worldwide

News from the Polytec Network

To provide our customers with the best support, Polytec is continually enhancing its capabilities.

In addition to its new headquarters in Irvine, CA, our US subsidiary has moved to a new location in Dexter, MI (near Ann Arbor) with enhanced capabilities (see page 27). Our French colleagues have also moved to a new and larger facility at Chatillon near Paris while our Japanese subsidiary is operating from a large new office on the 13th floor of the Arena Tower in Yokohama.

In addition to our direct sales, service and application engineering staff in the USA, Germany, England, Japan and France, we support a network of local representatives in Europe, Asia, South America, Australia and Africa. You will find detailed contact information about our worldwide representatives on our homepage at **www.polytec.com/worldwide.**

Polytec USA, Central Office, Dexter

Polytec Japan

Alain De Rozaven

Alain De Rozaven is the new General Manager of Polytec France, bringing with him more than 25 years of sales and management expertise in the electronics industry. We welcome him to the Polytec family!

www.polytec.fr

SAE Best Paper Award for NVH Simulation Research at Saab

Congratulations to Jens Weber at Saab Automobile AB for winning the SAE Best Paper Award for his publication about Squeak & Rattle Simulation at the 6th International NVH Congress at Graz, Austria, by help of Polytec's PSV-400-3D Scanning Vibrometer (see page 6).

Congratulations

2010 Karl Kessler Industry Award for Diploma Thesis at Polytec

Congratulations also to Robert Kowarsch who was awarded with the 26th Karl Kessler Prize for his Diploma thesis titled "Experiments on the Omnidirectional Doppler Effect" based on research work at Polytec. He has now joined Polytec as a development engineer working on new optical technologies.

Polytec Website Reloaded

Polytec's new website went online in September. It is designed with a clear layout and an extensive range of product features, eBooks and videos, interesting background information and many new features, including RSS feeds and social networking bookmarks. In addition, engineers and scientists can review regularly updated free Webinars on a range of relevant topics. We hope the new website will become a comprehensive interactive learning and information platform for optical technologies.
Visit it at www.polytec.com

The Secret Sounds of Music

Photo: Majvdl, Wikipedia

The Mystery of Eric Clapton's Guitar

While conducting a Scanning Vibrometer training seminar at Swansea Metropolitan University, Polytec UK engineers and attending users took the opportunity to measure the vibration characteristics of one of Eric Clapton's famous acoustic guitars. The guitar was completely characterized with regard to frequencies and deflection shapes. However, the secret of Clapton's genius was not revealed.

Comparative Material Testing of Organ Pipes

In Germany, organ pipes are generally made from a tin-lead alloy, whereas in the United States zinc is often used. To determine whether using zinc in Germany was appropriate, investigations were made into how the material used would influence the sound. Wall vibrations of tin-lead alloy and zinc organ pipes were measured by a 3-D Scanning Vibrometer and revealed significant differences in vibration properties. However, subsequent acoustic measurements showed that the pipes can be voiced to generate the same sound. The research results were clear – the "soft" zinc strip developed by the Grillo-Werke AG can be a suitable substitute for the tin-lead alloy with respect to the sound quality.

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Musical instruments generate wonderful, inspiring sounds through their vibrations. Polytec vibrometers can help us to discover the secrets behind these sounds, with early work already done on violins, cembalos and dulcimers. Even "secret sounds" can be unveiled through testing with this technology. Read on to learn about some of the recent applications including guitars, pipe organs and steelpans. www.polytec.com/acoustics

Polytec sponsors Research on "Secret Sounds"

For their long-term project titled "Unveiled Presence" (secret sounds), the media artists, Natalie Bewernitz and Marek Goldowski, are exploring characteristic sounds and acoustic properties of the city of Helsinki. During the month of May, they used a PDV-100 Portable Vibrometer from Polytec to capture hidden vibrations of city objects and places through laser light. As a first step, the artists arranged the data into an audio-visual presentation at the Cartes Flux 2010 Festival in October 2010 at Helsinki.

http://cartes-art.fi/flux2010/?p=137

Modal Testing of a Caribbean Steel Drum

Steelpans are instruments which generate a large number of notes from a single membrane. In this work, modal testing was conducted on a soprano pan, obtaining resonant frequencies and mode shapes that provide a spatial illustration of modal tuning when using the instrument. A soprano pan was excited with a loudspeaker and its response recorded by a 3-D Scanning Vibrometer. The results reveal the nearly harmonic relationship among tuned modes in each outer note. There is also significant modal coupling between adjacent notes that have harmonically related frequencies.

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Full paper:
www.polytec.com/acoustics

Non-destructive Testing in Industrial R&D

Non-destructive testing (NDT) is a broad category of analysis techniques used in science and industry to evaluate the properties of a material, component or system without causing damage or requiring the destruction of a test specimen. In this article learn about some exemplary NDT applications of Polytec's Scanning Vibrometers in automotive development, aerospace engineering, electrical engineering, acoustics, and power plant engineering (page 6).

Validation of Acoustic Emission Signals

It is well known that acoustic emission signals can be strongly affected by contact sensors. To get a better understanding of the main influencing factors, researchers at the Institute of Product Engineering at Karlsruhe (IPEK) used a Polytec 3-D Scanning Vibrometer for non-contact and non-reactive (zero mass loading) acquisition of the vibration and surface wave data on a test structure in combination with conventional contact sensors.

The full article is available at www.ndt.net/article/ewgae2010/papers/11_Dickerhof.pdf

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Finite Element Model Optimization of Satellites

The FalconSAT program is a student-run, faculty-led program to design, test, and eventually launch a small satellite. Accurate predictions for the dynamic responses of space launch payloads are not achieved easily. The finite element (FE) method has proven to be the best approach in creating precise dynamic models of complex structures. Researchers at the Air Force Institute of Technology (AFIT) have developed a process for extensive modal testing using the Polytec PSV 400-3D Scanning Vibrometer to create an FE model whose dynamic response closely matches the measured response of the satellite.

The full article will be featured in next issue of InFocus.

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Reliability of Mechatronics Systems

The reliability of embedded electronic systems is a major concern for transportation safety and for winning business in aeronautic and automotive markets. For over 10 years, the French CEVAA Automotive NVH Testing Center has utilized Scanning Vibrometers to acquire mechanical response data during R&D and industrial process validation, and to understand the dynamical behavior of PCBs and small mechatronics. Generally, the use of accelerometers is not appropriate for such small systems. In contrast, a laser-based measurement enables precise modal analysis over a wide frequency range from a few Hz to up to 50 kHz. By combining FE methods with fatigue testing and prediction, board designs and assembly can be optimized.

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Squeak & Rattle Simulation in the Development of the New Saab 9-5 Cockpit

A new approach to squeak and rattle simulation has been developed and used in the design of the new SAAB 9-5. This engineering tool covers the complete development process of interior parts without needing to manufacture prototype hardware. In order to determine the full capability of this tool, correlations between measured test pieces and simulated design pieces were performed including measuring vibration directly with the PSV-400-3D Scanning Vibrometer.

The full article is available at http://papers.sae.org/2010-01-1423

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Technology and Safety Challenges

The importance of wind power as a source of energy is steadily on the rise. The German Federal government is currently planning on increasing the contribution of wind power to electricity generation by 25% by the year 2025. Wind turbines are subjected to strong vibrations and mechanical stress during operation. Therefore, they must be designed with high fatigue strength and their dynamic behavior must also be checked regularly

Fig. 1: Test station at the IMA in Dresden. The rotor blade is shown with additional mass loads.

Strengthening Clean Energy

Non-contact Vibration Measurements of a Wind Turbine Rotor Blade

Fig. 3: Scanning Vibrometer measurement head is shown mounted on the hydraulic platform.

(condition monitoring). In this case, vibration testing using laser vibrometers can immediately provide several advantages. For example, the tests allow you to validate existing simulation models as well as inspect the quality of rotor blade construction and production. In addition, the measured vibrational behavior enables you to determine the ideal positions for installing fixed sensors to monitor the turbine's condition.

Fig. 2: An electromotive shaker made by Wölfel generated the excitations.

Preliminary Investigations were Very Promising

Measurements using laser vibrometers have already been conducted at the University of Applied Sciences in Flensburg, Germany, during a project aimed at researching sensor-supported condition monitoring systems [1]. The test measurements were made on a 300-kW plant with a hub height of 50 m and demonstrated that laser vibrometers are well-suited for non-contact remote diagnostics of vibrations on wind turbines.

Single-point vibrometers equipped with a telephoto lens, telescopic sight and autofocus are custom-designed for field use. In contrast, a scanning vibrometer is the ideal measuring device for determining the normal vibrational behavior (deflection shape) of rotor blades on the test bench with high local resolution and accuracy.

A Project with Many Partners

The measurements presented here are the result of a project geared toward diagnosing wind turbines. German project partners include the IMA Institute for Materials Research and Application Technology in Dresden, the Fraunhofer Institute for Non-Destructive Testing Procedures (IZFP) in Dresden and the engineering consulting company Wölfel-Beratende Ingenieure GmbH in Höchberg.

For the measurements, a 40-meter long rotor blade was horizontally fixed to a foundation at the IMA premises (Fig. 1) The upper surface (aerodynamic suction side) was subjected to horizontal vibrations approximately 10 meters from the center using an electrodynamic shaker developed by Wölfel (Fig. 2). A periodic chirp signal in a frequency range of 3 – 100 Hz with a resolution of 62.5 mHz was applied to excite the rotor blade. An acceleration sensor on top of the blade and 16 meters from the center served as a phase reference for animating the deflection shape. Since there was an emphasis on the upper side of the blade, the vibrometer's measuring head was mounted on a hydraulic platform (Fig. 3) and moved above the rotor blade as shown in Fig. 4.

The large clearance between the measuring head and the measurement object enabled researchers to capture a significantly larger surface area in one scan.
A total of 531 measurement points on the suction side (top) and 480 measuring points on the pressure side (bottom) were used to construct the deflection shape. The geometric coordinates and the FFT spectra of the vibrations were measured with high resolution. The PSV-400 equipped with the long range optics in conjunction with the VD-08 Velocity Decoder and a 5 KHz low-pass filter were used to record the measured data.

Fig. 5: Eigenmodes of the 40 m rotor blade, torsion mode at 10.9 Hz (top), contour mode at 12.44 Hz (bottom)

Fig. 6: Combined eigenmodes, at 17.63 Hz (top), at 21.81 Hz (bottom)

Fig. 7: Combined eigenmodes, top at 29.75 Hz, bottom at 36.13 Hz

Comparing Simulation and Measurements

The rotor blade's eigenmodes were determined from the measurements. Due to the geometry of the test arrangement, the measurements were each taken in sections covering several meters. These were then stitched together in one complete image using the PSV software. The measured natural frequencies below 22 Hz provide a good match with the model calculations and the existing measurements taken by the Wölfel company [2] (Fig. 5 and 6). The shaker used could not excite natural frequencies below 3 Hz and, therefore, data at these frequencies was not taken.

Summary and Outlook

The measurement results provide the natural frequency vibration patterns of the entire rotor blade as well as the vibration amplitudes of each individual scanning point in conjunction with the current positions in the 3-D coordinate system. Calculated models are easily and quickly compared with the real dynamic behavior to make constructive adjustments where necessary. The measurement data also enable the engineer to quickly and efficiently determine the optimal measuring points for attaching contact sensors in order to construct condition monitoring systems.

While the natural vibration levels should only change slightly according to the model calculations, larger changes in the eigenmodes are to be expected if the model is incorrect. Scanning vibrometers are ideal measuring systems to record a for measuring and confirming the modal model of a structure's eigenmodes (deflection shapes) with high local resolution and accuracy. With contact sensors, a comparable measurement would be very complex and time-consuming. Scanning vibrometers on the other hand enable users to set up a straightforward testing facility and quickly take non-contact measurements. In this case, the whole measurement procedure including setup and mounting could be performed within 8 hours.

Fig. 4: Rotor blade is shown with the 20 m high hydraulic measurement platform (left); Top view of the measurement field (right).

Literature

[1] Laser Vibrometers Make Non-contact Vibration Measurements on Wind Power Plants, Polytec InFocus 2/2008, www.polytec.com/infocus

[2] Ebert, C.; Friedmann, H.; Henkel, F.-O.; Frankenstein, B.; Schubert, L., 3. VDI-Fachtagung Baudynamik, Kassel 2009, VDI reports 2063.

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Optical Sensors Improve Industrial Production

Contact-free Measurements of Vibration, Length, Speed, Shape, Surface Quality and Composition Ensure Optimum Processes and Products. More Info: www.industrial-test.net

Throughput and quality are two critical factors that help determine the profitability of industrial production processes. In this respect, quality assurance implemented using rapid, automated and robust inspection technology greatly facilitates both throughput and quality of products. In addition to statistical process control using random sample measurements, 100% part inspection is more common now due to the frequent requirement for zero error rates. When considering uninterrupted flow of material and continuously generated goods, the ideal solution is online analysis with contactfree measurement procedures.

Flexible Sensors from Polytec

Polytec designs innovative optical sensors for industrial applications. Based on interferometric and spectroscopic principles, these sensors are compact and robust, built to survive harsh industrial environments. They are successfully deployed around the world, providing critical measurement values in real time which are essential for identifying faulty components or correcting critical process parameters. Because no contact with the test object is required, measurement values are not affected by the measurement. Sensors such as laser vibrometers, scanning white light interferometers and spectrometers can be easily integrated into the test environment without any additional complexity. This allows for high throughput with low maintenance overhead.

Impressive Solutions

In the following articles, you will learn how Polytec's optical sensors provided optimized solutions for quality assurance in the production of electric motors, automotive components, semi-finished products and bulk solids.

The IVS industrial vibrometer series, including the latest generation IVS-400 digital unit, is a trusted and widely used sensor for acoustic quality control and vibration analysis. TRW Automotive in Gelsenkirchen, Germany currently uses 22 vibrometers for their production line, performing 100% inspection on steering transmission components (see images on this page and Polytec application note VIB-C-04). TRW has developed its own analysis system, which combines order analysis with pattern recognition.

Vibration Measurement Systems

Polytec laser vibrometers detect vibrations and acoustic signatures without contact, delivering an objective evaluation of product quality with no sensor influence (pages 10, 12 and **www.vibrometry.com**).

Length and Speed Sensors

Polytec laser surface velocimeters ensure precise compliance with length requirements and feed speeds in the production of web materials (pages 19 – 21 and **www.velocimeter.us**).

Surface Measurement Systems

TopMap systems from Polytec monitor critical surface tolerances for manufactured parts in the production process, thereby ensuring that all parts will fit and work properly once assembled (page 16 and **www.topmap.info**)

Spectrometer Systems

Process analytics measures the composition of material flow and products, optimizing process control and assuring precise compliance with the specified product quality requirements (page 14 and **www.polytec.com/process-analytics**).

100% Inspection
of Vehicle Tolling Computers

Acoustic Testing Delivers 100% Quality Inspection of On-Board Tolling Computers

At Continental AG, Polytec industrial vibrometers are used for 100% inspection of tolling computers. The IVS-400 Industrial Vibrometer is integrated into the tolling computer test station to measure the structure-borne sound of a component without direct contact, ensuring that a specified target value is met and that the component functionality is assured.

Tolling Computers Help Fund Growing Infrastructures

Increasing freight traffic and volume on roads and highways are being forecast. To develop the necessary infrastructure and to properly maintain it, tolling systems have been developed which automatically capturing individual journeys and permit allocating toll charges by individual use. The on-board tolling computers are developed and produced by Continental for the German and European markets.

Fig. 1: Various tolling units.

The product portfolio covers all aspects of the tolling system (Fig. 1). In addition to the dashboard and front screen solutions that can be retrofitted to existing vehicles, DIN slot solutions are being offered. Continental is also providing the on-board units for the Slovak Republic.

100% Inspection in Production

To ensure the uninterrupted service of the tolling computer, the final units are subjected to 100% inspection. In addition to testing the actual functions, for example GPRS tests, the keys are tested mechanically with the aid of a robot. Acoustic testing of the alarm buzzer is also performed. The measurement task involves comparing measured outputs with predefined amplitudes according to vibrations produced at 2,700 kHz for example. All measurement data must be recorded. The acoustic testing has been carried out in a closed cell (to screen out external noises) using a microphone measure-

ment, but this procedure has been relatively unreliable, possibly as a result of the reflections inside the closed housing.

Measurements independent of Ambient Noise

Preliminary tests with an IVS-400 Industrial Vibrometer, initially in the lab, then directly on the production floor under real conditions with running machines, provided such promising results that Continental has decided to integrate these vibrometers into the final test station. The vibrometer makes measurements without making contact, is free from wear and works without specialized fixures or noise insulation. The high level of noise in the production environment does not affect the measurement results because the laser vibrometer measures the structure-borne sound on the surface of the device under test. Since the IVS-400 uses a collimated laser probe, measurements can be made from great distances without any problems, and the selection of the sample point is not critical. For standardization or "referencing" between the required airborne sound level required and the structure-borne sound measured, a "golden sample" is required to verify and calibrate the frequency and amplitude limits.

Seamless Integration into the Production Environment

The IVS-400 Industrial Vibrometer (Fig. 2) is a Single-Box-Solution, only needs a small amount of space and can manage the measurement task from a suitable stand-off distance because of the laser probe and measurement principle. By linking the vibrometer into the production process, integrated real-time 100% quality control on the components with good/bad evaluation is possible. The inspection process can be automated and can be realized with the help of appropriate Visual Basic® macros. It is simple for the customer to program, change and maintain the macros. The interface between the vibrometer and the process control system is also standardized. The IVS-400 is equipped for future applications (new test specimens or other measurement parameters) with its wide frequency response, making investment in the technology really worthwhile. The IVS-400 helps ensure product quality and increases the cost-effectiveness of the production process.

Fig. 2: IVS Industrial Vibrometer in a test stand at Polytec (not related to the application described here).

Polytec's Industrial Vibrometers – Reliable Measurements under Harsh Conditions

The **IVS-400 Industrial Vibrometer** is an integrated single-box digital vibrometer, specifically developed for non-contact vibration measurement in production test applications. It features a robust and compact design, sealed (IP-64 standard) to cope with the challenges of harsh industrial areas. It exploits the latest digital signal processing techniques to ensure accurate and repeatable measurement from uncooperative surfaces. Further benefits include three measurement ranges up to ±500 mm/s, an excellent signal/noise ratio and a linear frequency response from 0.5 Hz up to 22 kHz.

The all-in-one **CLV-2534 Compact Laser Vibrometer** comprises a 19" rack-mountable controller supplying laser power to the vibrometer head via a fiber optical cable. The unit is compact and flexible in application. Surface vibration is measured in velocity and displacement with high precision and low noise over a bandwidth of 3.2 MHz at 10 m/s maximum velocity. A wide range of options such as an integrated video camera and microscope objectives make the CLV-2534 an ideal tool for industrial and lab measurements on structures varying in size from the micro to the macroscopic.

More Info:
www.polytec.com/vibrometers

Reliable White Goods

High Throughput Production Testing of Electric Motors for Household Appliances

Arçelik is a Turkish company which manufactures household equipment and entertainment electronics and sells them in more than 100 countries. To support this worldwide business, Arçelik has an impressive research and development department. During production of electric motors for these products, acoustic tests and vibration measurements are made for quality control purposes to ensure that given tolerances are met. Using laser vibrometers, these measurement tasks can be done at a high production rate by exploiting the non-contact properties of the measurement technology.

Maintenance-free Sensor System

The Polytec IVS Industrial Vibrometer is particularly suitable for making measurements in production plants. This vibrometer uses a laser beam (Fig. 1) as a measurement probe and has no external control elements; it is configured via the internal serial interface so that it is not possible to accidentally change the settings during service and maintenance work.

Other advantages of this optical measurement technology include:

- Simplified installation eliminates mechanical fixturing and direct contact with the object being tested.
- Measurements in difficult to access regions are allowed by the small probe size.
- The vibration characteristics of the test specimen are not affected by a probe mass, for example the mass of an accelerometer.
- The technology can be quickly adapted to various types and versions of test specimen and to the test environment.

Customized Test Procedures

Two methods are predominantly used to test the motors: making measurements while the motor is warming up and/or making measurements at a constant RPM (Fig. 2). This means that a test bench must be designed to have flexible control of the motor speed, including acquisition and monitoring of the actual RPM on the motor to be tested. During the measurement, the structure-borne sound vibrations at the individual measurement points are recorded and then evaluated using software.

Depending on the test stand, the RPM is specified by setting a control voltage, for example by using a function generator without feedback, or by setting the motor speed directly and actively regulating it. In the first case, the actual motor speed must be measured using an encoder or an analog voltage which is proportional to the motor speed.

Fig. 2: Time-speed diagram for the two different measurement procedures.

Fig. 1: Example of a measurement using a laser vibrometer to characterize an electric motor.

Fig. 3: Screen shot of the evaluation module in the QuickCheck test software.

The test procedure is controlled and evaluated using the Polytec QuickCheck test software. The function generator integrated into QuickCheck allows the setting of a trapeze shaped speed profile with an adjustable increase, an adjustable maximum voltage and a variable duration of the constant voltage. The measurement time is adjusted to correspond to the total duration of the measurement cycle. Alternatively, the measurement time is specified according to the production cycle and the motor speed profile is adjusted accordingly.

Simultaneous with the setting of the motor speed, the vibration signals are measured. The measurement data can be divided into sections on the basis of the motor speed specifications or the actual measured speed. A section can incorporate traversing the RPM range from 500 to 2,500 RPM or, as shown in Figure 2, from 8,000 to 15,000 RPM. On the basis of the velocity signal, the software searches the relevant time domain and analyzes the vibration signals acquired in this range. This time signature can be different for every motor and arises out of its dynamic behavior.

Efficient Evaluation

With QuickCheck, there is an evaluation model available for the test bench which makes such tests very easy and user-friendly (Fig. 3).

For this analysis, an RPM range is given initially. The QuickCheck software only analyzes the corresponding measurement data from the individual measurement channels in the relevant time section and then calculates the spectrogram for this data using an adjustable block size. Various characteristics are calculated from this data and can be compared to specified limits (for example, the band energy or the peak value in the frequency range from 100 to 300 Hz). The software allows any number of characteristics to be calculated in an RPM range and any number of RPM ranges can be defined. These ranges can even overlap each other.

When measuring at a constant speed, a specified time domain can be selected for the analysis. Setting and calculating characteristics can be done with the options described above. For off-line analyses, the measured time signals can be saved for subsequent order analysis.

All characteristics calculated in this way are shown in a table in the QuickCheck test software. For the tested motor to pass the test and move on to the next manufacturing step, all characteristics must be within their specified limits. The measurement values can easily be saved in a database with the time stamp of the measurement. QuickCheck also allows the serial number of every motor to be read by bar code or data-matrix code and the value can be saved with the corresponding measurement values. This is an extremely useful feature since it is possible to trace the individual production and testing results for each product at any given time.

www.industrial-test.net

QuickCheck Software

QuickCheck is a multichannel, PC-based software for semi or fully automatic process monitoring and quality control based on the vibration behavior of the products. QuickCheck acquires and evaluates the measurement signals, makes the pass/fail decision, controls the test routine and communicates with the customer's process control system.
www.polytec.com/software

Author: Wolfgang Ochs, Polytec GmbH

Real-time Process Control

Incorporating Polytec Spectrometers into process analyzers allows inspection to occur in many areas of the production cycle: from incoming inspection to final product certification. More info: www.polytec.com/process-analytics

NIR Spectrometry Ensures Quality, Process Optimization and Cost Efficiency

Process analytics is used for automated real-time control of production processes. In addition to ensuring consistent product quality, the production process itself is improved. Near Infrared (NIR) spectrometry can be used to ensure quality, process safety and overall cost efficiency.

NIR spectroscopy provides analysis and monitoring of many parameters, including qualitative and quantitative chemical composition, particle size and layer thickness.

Process Analytics for Solids

Polytec Spectrometer Systems enable efficient online control of solid materials. Possible applications are the monitoring of bulk goods on conveyor belts or other transport systems.

Process Analytics for Fluids

The online control of fluid media by Polytec Spectrometer Systems can be applied to fluids in tubes, reactors and open vessels. Measurements can be performed on liquids, dispersions, and pastes.

Process Analytics for Gases

Polytec Spectrometer Systems allow for online monitoring of gases, aerosols, smoke, or dust.

Advantages of NIR Process Analytics:

- Real-time process monitoring and control
- Non-destructive, non-invasive
- No sample preparation or wastage
- Increased efficiency and cost reduction by reducing rejects
- Suitable for statistical process management
- Proven technology

Process analytics for solids

Process analytics for fluids

Process analytics for gases

Flexibility and Precision: The Modular System Design

The standardized set of sensor heads together with spectrometers and process software packages are powerful tools for qualitative and quantitative online analysis. The PSS systems bring together innovative technology and robust design, delivering fast and reliable data.

Benefits of the Modular System Concept:

Standardized equipment and software which together provide

- high flexibility
- easy integration
- simplified operation

resulting in time-productive, cost-effective, and convenient measurement solutions.

Polytec Spectrometer Systems (PSS) are specifically designed for flexibility and are applicable to both online process control and laboratory measurements

Watchful Eyes: NIR Sensor Heads

Adequate sample presentation is the key to successful system operation. A variety of specialized sensor heads are available for addressing different sample properties and installation situations.

Efficient Measurement and Control: Precision Spectrometers

Diode array technology is combined with a superior transmission grating design so that PSS spectrometers can be used for fast and reliable data acquisition.

From Signal to the Measured Values: Polytec PSS Software

Depending on the intended purpose, dedicated software solutions are available for laboratory data acquisition, multi-variate data analysis and process control.

NIR Sensor Heads

Spectrometers

Polytec PSS Software

Function Driven by Precision

Implementing and Standardizing Optical Methods for Characterizing Surfaces in the Industry

Automotive engines should offer fuel efficiency and emit hardly any pollutants, while offering ample performance and a high level of driving comfort. Achieving this requires the optimum interaction of all components. In turn, this demands compliance with precision shape tolerances for the individual functional components. For the manufacturer, this means that compliance with these tight tolerances must be guaranteed during quality checks in manufacturing to preclude customer complaints or even recalls. www.topmap.info

Fig. 1: TopMap Metro.Lab White-Light Interferometer.

Fig. 2: TopMap In.Line White-Light Interferometer.

Fig. 3: Measuring a workpiece with surfaces at various depths.

Precision measurement equipment with excellent reproducibility is required to characterize surfaces. Stylus (contact) profiler methods have been used for such tasks for a long time. With these methods, the tolerances are inspected using individual measurement points or through linear scans. Line-only profiles are often inadequate, especially when the entire surface must be analyzed to determine flatness or parallelism. To determine the surface topography using stylus methods, many parallel line profiles are recorded and combined into a single surface. These measurements are very time-consuming and are not acceptable in production quality control situations where throughput is critical. Because fast measurements over large surface areas are easily accomplished using optical measuring methods, these techniques are increasingly in use for production applications.

High Vertical Precision with a Large Lateral Field-of-view

In many cases, flatness measurements are needed that relate several individual sur-

faces, such as comparing the surface at the bottom of a blind hole with the surface at the top of the hole. The vertical measuring inaccuracy of white-light interferometry is independent of the lateral field-of-view. This enables the measurement of large surfaces with high vertical resolution. Polytec developed the TopMap White-Light Interferometers for mastering these measurement tasks. This product line offers an excellent price/performance ratio and can, for example, quickly and reliably measure flatness, parallelism and step height. TopMap MetroLab (Fig. 1) was primarily developed for a metrology lab performing statistical process control measurements. The TopMap In.Line (Fig. 2) was designed to be integrated into the production line when needed.

Measuring Flatness and Parallelism in Quality Control

The two workpiece surfaces displayed in Fig. 3 are to be inspected for flatness and parallelism, where one surface is 50 mm deeper than the other. The TopMap MetroLab White-Light Interferometer, with its vertical scan range of up to 70 mm, is the ideal solution for skillfully performing such measuring tasks. The device features a telecentric optical path. This means that the light beam virtually runs parallel to the object (Fig. 4). Unlike a microscope that has a cone-shaped beam pattern, there are no shadows with the TopMap Metro.Lab. This also allows the light beam to reach deep surfaces.

Fig. 4: Typical microscope optics (left) fail to characterize high aspect ratios when compared to Polytec's telecentric optics (right).

The surface of the workpiece to be measured can be smooth or rough, dark or light, with a specular or a light-scattering surface. A special measurement and analysis algorithm (smart surface scanning) ensures excellent results, even if the surface has spatially varying optical properties. The measurement duration depends on the task at hand and usually takes only a few seconds. A special add-in also enables you to easily automate routine measurements and ensures that the necessary data is acquired for an accept/reject analysis or for external quality assurance software. A pallet can also be installed for automatically feeding and measuring the workpieces for serial measurements. If the measurement is to be taken on the production floor, Polytec offers a dust-free and vibration-insulated workstation (Fig. 5). The short measurement times that can be achieved with the white-light interferometer can also be integrated into the production line for 100% inspection. For example, the automotive industry is currently using a TopMap system to measure precision components for drivetrains on the production line.

Fig. 5: Workstation for TopMap White-Light Interferometer.

Fig. 6: Shock absorber component with several annular surfaces.

Typical flatness measurements [1]				
Sampling increment	Nominal sampling increment		Fast sampling	
Evaluation procedure	Smooth surfaces [2]	Rough surfaces [3]	Smooth surfaces [2]	Rough surfaces [3]
Flatness deviation	10 nm	65 nm	12.5 nm	75 nm
Repeatability of flatness measurement	0.75 nm	3.5 nm	1.25 nm	5.5 nm
Average flatness deviation	10 nm	65 nm	12.5 nm	75 nm

[1] Rounded values from the empirically measured data and a statistical analysis determine the deviation of the measured flatness for various TMS-300 devices with various sampling increments for both evaluation procedures. (Measuring on a flat mirror (95% of the maximum measuring field, interference contrast ≈ 1)

[2] Evaluation of the correlogram phase

[3] Evaluation of the correlogram envelope

Table 1: Specification for flatness measurements with TopMap In.Line.

Fig. 7: Step height profile of component along the dotted line in Fig. 6.

Traceability, Repeatability and Reproducibility

International standardization for optical measuring methods is still behind the well-established, traditional scanning stylus measurement procedures. Although the ISO 25178-604 draft covers the general aspects of the white-light interferometer, it does not address the important issues regarding telecentric systems. The VDI/VDE directive 2655 sheet 1.3 deals with this topic in greater detail. In collaboration with the German PTB (National Metrology Institute) and other institutes, Polytec has contributed an abundance of preliminary work in this area. Calibration methods and measurement uncertainties were presented and discussed at the SPIE Photonics Europe conference in the spring of 2010 [1]. It is difficult to verify the measurement uncertainties in the nanometer range over the entire vertical scanning range. However, experts have approved the factory calibration developed by Polytec. This permits Polytec to prescribe specification values that are considerably more detailed than is common in the market today (Table 1). Additional values for the TopMap In.Line (specifications for the vertical resolution, accuracies for measuring step heights on a standardized workpiece and the values achieved for repeatability and reproducibility measurements) can be found in the TopMap In.Line datasheet at www.topmap.info. Although the TopMap's capability must ultimately be verified on the specific workpiece, these figures provide strong evidence of the instrument's performance on individual measurement tasks.

Example

In particular, the strengths of white-light interferometry lie in measuring workpieces that are difficult to characterize using contact measuring systems. A specific example makes this clear. The component (shock absorber) shown in Fig. 6 has several annular surfaces, one of which is sloped. Contact measuring systems did not provide the accurate and reproducible results necessary for ensuring that manufacturing was meeting the part tolerances. However, measuring the entire surface using white-light interferometry enables an automated evaluation, which automatically detects the surfaces and evaluates them in a reproducible fashion. As a result, a very high level of reproducibility was achieved. This reproducibility also applied to measuring step heights between the individual surfaces that were inspected on this workpiece (Fig. 7).

Literature

S. Boedecker[a], W. Bauer[a], R. Krüger-Sehm[b], P.H. Lehmann[c], C. Rembe[a]: Comparability and uncertainty of shape measurements with white-light interferometers. SPIE Conference Photonics Europe, 12. – 16. April 2010, Brussels

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Polytec LSV Enables Modernization of Measurement Technology

Tata Steel (formerly Corus) runs an integrated steel plant at IJmuiden, Netherlands, where final products are made from ore and coke. One of the links in this process chain is the basic oxygen furnace where steel is made from raw iron in a blast furnace and cast into slabs in continuous casting machines. To ensure the quality of the slabs, the length of the strand from which they are cut is measured.

Previously, the length measurement of a strand from a continuous caster was made with contact rollers that were driven by the motion of the strand. Due to the increased production wear at the steel plant, this measurement was no longer accurate and produced many faults in the process. To improve the situation, a systematic investigation was carried out together with Utrecht University. The objective of the research was to obtain an alternative length measurement method which can replace the function of the measuring rollers by simultaneously overcoming their drawbacks. Most importantly, the measurements should be extremely reliable and virtually maintenance free. The study began by determining the precise function needed from the measuring roller in the given application. From this information, an alternative length measuring system could be proposed. Afterwards, different market solutions for length measurement of a strand in a continuous casting machine were evaluated.

Fig.1: Laser-Velocimeter measurement on the top of the strand.

Fig. 2: Polytec LSV Sensor at work.

The decision on the new measurement technology had to be made and the equipment purchased in 2009.

After examining a variety of possible solutions, the investigation was focused on the three most promising methods which were:

1. Laser distance measurement at the front of the strand in combination with the cutting machine
2. Laser-Velocimeter measurements on the side of the strand
3. Laser-Velocimeter measurements on the top of the strand

Of these three methods, there was only one deemed suitable, the Laser-Velocimeter measurement from the top of the strand (Fig. 1). This measurement was the only method that can measure the length at any time and allows the equipment to survive the extreme conditions of the measurements.

The Laser Surface Velocimeter (LSV) series from Polytec was identified as the best solution (Table 1) since it met all the requirements set by Tata Steel:

- Allows very accurate measurement even at very low material speeds as are typical for continuous casters
- Allows easy integration with process control systems (level-2 systems) using Polytec's flexible interface concept
- Survives the harsh mill environment of a steel plant due to a rugged industrial housing with cooling
- Short delivery time

The new Laser-Velocimeter length measurement system based on Polytec's LSV technology has now been successfully implemented with all project targets reached.

Comparison of Laser-Doppler Sensors

Specifications	Sensor 1	Polytec LSV	Sensor 3
Velocity range –2.5 m/min ... +2.5 m/min	no	yes	yes
Standstill detection	no	yes	yes
Bidirectional	no	yes	yes
Uncertainty max. 0.1% of measured value	yes	yes	yes
Temperature range 50 °C ...1200 °C	yes	yes	yes
Cooled housing	yes	yes	yes
Maintenance free	yes	yes	yes
Spare parts easily separate	yes	yes	no
Separate sensor	yes	yes	no
Separate processing unit	yes	yes	no
Encoder connection	yes	yes	yes
Diagnostics via level 2	yes	yes	no
Delivery period weeks	12	6	12

Literature

Cees Min, "Door Meten tot Weten", CORUS/Tata Steel internal report 2009.

LSV Improves Quality and Lowers Costs

Cut-to-length and Speed Control of Cardboard, Plastics Extrusion, and Other Non-metal Products

Laser Surface Velocimetry (LSV) is an optical method that can measure speed on virtually any surface. While often applied in steel mills and metal processing, LSV is equally effective in the production of nonmetallic goods such as wood, cardboard, foil, plastics extrusion, cable, building materials, textiles and fabrics. The image below shows the LSV determining cut-to-length of corrugated paperboard sheets. Please read on to learn about some exemplary applications.

Speed Synchronization in Paper Production Cuts Manufacturing Costs

In response to a significant number of breaks during splicing operations on a continuous coater, a paper mill installed a Polytec LSV on its high speed paper unwind. By integrating the LSV's surface speed signal into the control loop, the mill can consistently match parent reel speeds to within ±5 ft/min at 5,000 ft/min (±0.1%). The return on the mill's investment in the new technology was less than one year.

Length Measurement for Conveyor and Drive Belt Production

A leading manufacturer of drive and conveyor belts uses several laser surface velocimeters for length measurements at the cutting station. Thus, customer-specific cuts can be automated, simplifying the process significantly. The cut-to-length accuracy is independent of the belt surface and achieves a precision of 0.1%.

Contact your product specialist
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oms@polytec.de (all other countries)

Precision Measurement Reduces Scrap

Quality Control using Non-contact Measurement of Length and Speed on Rotating Tubes

To provide quality testing of steel tubes, a suite of non-destructive testing techniques are combined to facilitate a fast and complete assessment of the tubes. Where length and velocity measurements on rotating tubes are needed, Laser Surface Velocimeters are used to provide unambiguous position data during the test procedure.

Inspection facilities include processes suitable for non-destructive testing of seamless steel tubes such as electromagnetic inspection (E.M.I.), magnetic powder inspection (MPI), metallurgical tests and ultrasonic testing. Depending on the application and specifications, ultrasonic testing is applied over the whole length and perimeter of the tube for a comprehensive failure analysis. Testing of both longitudinal and transverse defects as well as the inspection of wall thickness and lamination are critical for quality control. In order to localize the defects, the actual testing method is combined with a position measurement technique like velocimetry. Laser Surface Velocimeters use the laser Doppler principle to evaluate the laser light scattered back from a moving object and to determine the exact motion and position of a tube in the test stand. The combination of methods provides a fast and complete testing of the tube.

Installation at the Ultrasonic Test Stand

A series of Laser Surface Velocimeters are used at the ultrasonic test stand to measure length and velocity of the tubes. The tubes that are passing through the facility are rotating with a speed of 2 m/s. Each inlet and outlet of the stand is equipped with two LSV-065 Sensor Heads, one for measuring the longitudinal motion and one for the lateral (rotational) direction. The title image shows the setup of the LSV-065 Sensor Heads and precision adjustment plates for measuring the longitudinal (left sensor) and rotational speed (right sensor) of the tube. The paired sensors at the inlet and outlet of the ultrasonic test stand provide clear measurement data for the determination of the tube's position while traveling through the stand. The translational speed is quite low in relation to the rotational speed (Fig. 1). Thus, the respective sensor head must be precisely aligned parallel to the travel direction in order to avoid any superposition with the lateral motion. Otherwise the translational speed would be too low or too high and cause errors in length measurement. The alignment on each sensor is enabled by finely adjusting a mounting plate and by following an adjustment procedure before starting routine operation. With the aid of precision set screws, the angular position can be controlled precisely.

Fig. 1: Superposition of translational and rotational speed.

Non-contact and Precise

Laser Surface Velocimeters combined with suitable accessories provide non-contact precision length and speed measurements even in the case of superimposed motions. For the ultrasonic test stand described here, where the tubes are performing two different motions with very different speeds, the achieved accuracy of the method (<0.1% of measured length) has proven to be more than sufficient for measuring both motions independently.

More Info:
www.velocimeter.us
www.velocimeter.co.uk

Measurement Technology for Industrial Sensors

Polytec's Micro System Analyzer is Essential for Developing Industrial Sensor Systems

The Industrial Sensor Systems (ISS) department at the Institute for Sensor and Actuator Systems at the Technical University of Vienna examines the following topics in the field of sensor technology:

- Physical chemical sensors
- Fluid components and sensors
- Micro and nano-systems for fast chemical and biological analyses (e.g., "Lab on a Chip")
- Sensors for automotive applications
- Magnetic field and radiation sensors
- Sensor system modeling and evaluation

The sensors are designed and manufactured at the institute using selected process technologies chosen specifically for silicon-based sensor production, some of which were developed in-house.

Measuring 3-D Dynamics and Surfaces Using Light

The applied research and development work on industrial sensor systems conducted by Prof. Dr. Keplinger and his staff in the ISS department demand corresponding state-of-the-art measuring equipment. The MSA-400 Micro System Analyzer at the institute and the MSA-500, its current successor, are all-in-one measurement systems for taking dynamic and static measurements on micro electro mechanical systems (MEMS, Fig. 1) and other microstructures. They allow you to analyze and visualize structural vibrations and the surface topography in microstructures and employ a unique combination of non-contact measuring technology procedures. **More Info: www.polytec.com/mems**

Miniature Spies in the Production Process

Professor Keplinger's department is developing innovative sensors that literally ride along with the production process and continuously transmit the chip-level pressure, temperature or other important process parameters during the individual steps in manufacturing to an external receiver. To measure the pressure, a small structure sensitive to changes in process pressure but compatible with the manufacturing steps must be designed, built and tested. Current designs use a statically deflecting structure and not a vibrating system. To provide performance data for refining the design, the Micro System Analyzer was used to measure the sensor deflection and sensitivity – without even touching the unit.

Fig. 1: SEM image of a micro electro mechanical system (MEMS). Image: K.L.Turner/UCSB

"The miniaturized pressure unit is only a few square millimeters in size, making the optical measurement procedure of the MSA the perfect solution for small object characterization. Contact measurement procedures would severely compromise the accuracy of the data when scanning the unit due to the influence of mass loading. To properly design the sensor, we need an uninfluenced measurement – an obvious case for optics-based probing using the MSA-400," emphasized Professor Keplinger.

"Another significant benefit to using the MSA over tactile instruments is made obvious when testing the MEMS devices under operating conditions. Tactile instruments can make measurements without too much effort only under ambient conditions. Our sensor development requires testing in a chamber at vacuum or high pressures. Modifying a tactile instrument to function inside such a chamber is not feasible unless a lot of effort is expended. Instead, our pressure chamber is fitted with optical inspection windows allowing us to make measurements with the MSA without any difficulty at all, regardless of whether the device under test is in vacuum or at a pressure of 5 bar."

Today's Research is Unthinkable Without the MSA

Professor Keplinger (Fig. 3) could not imagine performing his research today without the MSA-400. In the past, we frequently wound up with "measurement gaps" in our work. Some structural responses could only be calculated and not directly measured. Several years ago, research and development was focused on diaphragms, and then came bridges and moving beams. "Making the transition to working with microstructures without the MSA-400 would have been extremely difficult. In fact, it would have been impossible," surmised Professor Keplinger. Not only can the device measure single spot displacements, it can also scan surfaces without making contact and deliver a deflection shape.

Fig. 2: A newly developed sensor is shown with connected control electronics positioned under the objective lens of the micro system analyzer.

Fig. 3: Prof. Dr. Franz Keplinger (front) and two doctoral students of the ISS standing next to the "indispensable" micro system analyzer.

"We are now able to quantify responses we couldn't measure before – in etched holes for example. Or, perhaps, the significant effect of the surface area on device performance during miniaturization since volume reduction is a cubic function whereas area reduction is only a square function. With today's swift pace of technological innovation, we no longer have the time for trial and error. Measuring equipment like the Micro System Analyzer from Polytec is vital if you want to stay competitive", concludes Professor Franz Keplinger. Vienna is not the only place in Austria where researchers need to work with the MSA-400. Other Austrian universities are also competing for the limited time slots available to use Polytec's micro system analyzer. Although it is a complex system, the measurements performed on the MSA are intuitive and meticulously thought out. The detailed menu navigation and user-friendly program interface allow you to quickly begin taking data and doing complex analysis.

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www.ituw.at

Industrial Quality Inspection of MEMS Pressure Sensors

Pressure sensors in vehicles are used to determine the pressure in water, oil and various compressed air systems. With MEMS pressure sensors, the physical parameters to be measured create a reversible distortion of a specially designed mechanical silicon microstructure. Here, the micro system analyzer is used in the manufacturing process for characterizing specific sensor parameters at the wafer level. This way, defective components are detected and sorted out during the measurements – saving significant time, since other unnecessary processing steps can be avoided in the process. **www.mems-analysis.com**

Developing Ultrasonic Transducers at 100 MHz and More

Making Surface Vibration Measurements on Ultrasonic Transducers using the UHF-120 Ultra High Frequency Vibrometer

An increasing number of micro-components including sensors and actuators operate at ultrasonic frequencies in the high MHz range. A few examples of such high-frequency vibrating systems are: Micro-electromechanical Systems (MEMS), Nano-electromechanical Systems (NEMS), Surface Acoustic Wave (SAW) filters and ultrasonic sensors for imaging in medical applications. To develop these sophisticated systems, engineers must measure and characterize their dynamic behavior, testing and validating functionality, simulation models and optimum designs. Laser vibrometry is one of the few technologies that permits non-contact precision vibration measurement on such systems, eliminating mass loading and other traditional influences from contact measurements.

Until recently, Polytec vibrometers were limited to an upper measurement frequency of 24 MHz. With the new Ultra High Frequency Vibrometer that bandwidth limit has been increased by 50X. Engineers can now characterize devices with vibrations up to 1.2 GHz with the same simplicity and reliability that is inherent in all Polytec vibrometers.

Configuration of the UHF-120 Ultra High Frequency Vibrometer System

The UHF-120 measurement system (Fig. 1) includes the sensor head (1), the osilloscope (2), the measurement computer (3) and a controller (4) that interfaces the computer with the sensor head. In the event that the UHF-120 is used to make a series of measurements on the surface or to determine a deflection shape, the system can be configured for scanning by simply adding a motorized X/Y positioning stage.

Application	Frequency range
RF MEMS	1 MHz ... >3 GHz
SAW/BAW Filters	10 MHz ... >60 GHz
NEMS	50 MHz ... >1 GHz
HF Ultrasound Transducers	1 MHz ... >1 GHz

Table 1: Typical bandwidths of high-frequency components.

Medical Ultrasonic Sensors

The ultrasonic sensors to be measured were developed by the Fraunhofer Institute for Biomedical Engineering (IBMT, St. Ingbert, Germany) and are used in medical imaging. The purpose of the measurement is to determine the three-dimensional sound field dispersion in space by measuring the out-of-plane vibration of the components.

The ultrasonic sensors (transducers) are transceivers working as both a transmitter and receiver of ultrasonic waves. The out-of-plane crystal vibration caused by the piezo effect is transmitted to the thin membrane or matching layer above it. The membrane (or matching layer) generates an ultrasonic wave, the shape and frequency of which can be changed by varying the control of the piezo field.

Fig. 1: Setup of the UHF-120 system.

Measurement of a High-frequency Ultrasonic Sensor

The design of this sensor has a surface measuring 0.8 x 2.4 mm² and has a characteristic frequency of 105 MHz. Prior to making the measurement, the sensor was covered with a 1 mm thick layer of water under a thin cover glass.

This configuration allowed a realistic measurement of the transducer to be made. Depending on which contacts (Fig. 2) are excited on the sensor, different areas of the membrane will respond accordingly. Thus, for example, by making a scanning ultrasonic measurement various areas of the membrane are shown to vibrate in phase with each other, thereby transmitting sound waves at various positions. The sound waves generated like this are reflected in the object under test and are then detected again by the ultrasonic sensor.

In Fig. 3 the results are shown after excitation of four piezo fields in the middle area of the ultrasound transducer. It can be seen that a surface vibration of the membrane is generated by the piezo array over a sharply defined area. The settling time of the membrane vibrating at around 105 MHz is approx. 0.5 µs. The maximum amplitude of the membrane corresponds to a bit more than 150 pm. Based on the deflection shape of the membrane and the strong attenuation of the water layer, only the area of the membrane excited by the piezos immediately beneath it will start vibrating. The measurements indicate that an almost flat and sharply focused sound wave is generated by the membrane.

Fig. 3: Vibration characteristics of the high-frequency ultrasonic sensor. Image: IBMT

Fig. 2: Microscopic image of the high-frequency ultrasonic sensor covered with a 1 mm thick layer of water and a thin cover glass.

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Summary

On the basis of the out-of-plane vibration measured in the water, it was possible for the IBMT to improve their model and spatially simulate the sound field generated. The measurement in the water serves as a realistic basis for the simulated sound field. With the UHF-120 Vibrometer, it is relatively easy to determine the vibration characteristics of high-frequency vibrating systems with great precision. Besides the high accuracy of the measurement procedure, a significant advantage of the UHF-120 is the simple setup and fast measurement times that can be decisive in the sensor development process.

At the IBMT, it has been possible to significantly reduce the time required to determine the ultrasonic field through surface measurement of the transducer.

As an alternative to measuring the three-dimensional sound field using a noise sensor installed in the room, it is now possible to determine the resulting sound field simply from one or more scanned measurements and a subsequent simulation.

Product News

Mapping High Frequency Nano Devices Using the UHF-120 Vibrometer

The new UHF-120 High Frequency Vibrometer is designed to characterize mechanical motions at frequencies up to 1.2 GHz, enabling the precise examination of RF-MEMS and ultrasonic transducers. Equipped with the new scanning feature, the UHF-120 can measure deflection shapes which can be visualized in slow motion. Even structures such as nano-electromechanical systems (a nano-sized cousin to MEMS) can be characterized with high lateral resolution at high frequencies and short acoustic wavelengths.

To facilitate precise characterization, the UHF-120 vibrometer can be integrated into a variety of wafer probe stations including vacuum probe stations.

More Info: www.polytec.com/uhf

New PSV-400-M4-S Scanning Vibrometer

To validate the Finite Element (FE) models used in the design of safe and effective ultrasonic actuators for medical and industrial applications, Polytec has added another high frequency and high amplitude model to its already extensive non-contact vibration measurement systems product line. The new PSV-400-M4-S provides full-field data for components both large and small. The integrated visualization shows directly where and how ultrasonic energy is coupled into the transducer. In addition, the system allows the visualization of sound fields generated by the transducer, for example in medical ultra-sound, by means of refracto-vibrometry.

More Info: www.polytec.com/scanning

New PSV Software Version 8.8 and VibSoft 4.8

PSV Software is critical to the performance of every Polytec scanning (full-field) vibration measurement system, including the Polytec Scanning Vibrometers and Micro System Analyzers.

VibSoft is the single-point companion software that supports all single-point vibrometers in a similar powerful way. The focus of this release was on improved usability. To easily compare results, analyzer views can be coupled, such that cursor positions and zoom levels are automatically transferred to the coupled windows. The "Presentation Mode" is available during a measurement to improve productivity. To avoid saturated points, the new Autorange function automatically changes decoder settings when the amplitude is out of range. Improved alignment stability and geometry accuracy is achieved by the VideoTriangulation function, which is now standard for all PSV-3D systems. With a STL geometry file interface and improved handling of imported measurement data, Polytec continues its way to a full CAE integration. All new Scanning Vibrometer Systems are now based on the 64bit version of Windows 7 for a smooth handling of large data files.

More Info: www.polytec.com/software

OFV-2520 Dual Channel Vibrometer Controller

With the new OFV-2520, Polytec upgrades its dual channel controller series to be fully compatible with all single-point vibrometer heads, making simultaneous measurements from two heads as easy and flexible as from one head. Added push buttons for autofocus and beam shutters give direct control over the vibrometer system while added tracking filter capability significantly enhances measuring results on surfaces with low reflectivity. The OFV-2520 is Polytec's new option for demanding dual channel measurement applications up to 3.2 MHz.

More Info: www.polytec.com/vibrometers

New TMS Software Version 3.1 Enhances Surface Metrology Measurements

Polytec announces the release of TMS 3.1, a comprehensive revision of its measurement and analysis software for the TopMap series of optical surface profilometers. In addition to being easy-to-use, the TMS software, developed under .NET, offers features that include extended analysis options, automation with C# scripting (add-ins), a multi-document interface and a particularly powerful and innovative 3-D visualization module.

More Info: www.topmap.info

RoboVib News

The Next Step in Automated, Full-Field 3-D Vibration Measurement

RoboVib is a Structural Test Station that removes many of the limitations of traditional contact transducer methods. By mounting a 3-D Scanning Vibrometer to a multiaxis industrial robot, RoboVib is engineered to be a stable, auto-configurable 3-D vibration measurement station for whole body vibration mapping of complex-shaped objects. This unique combination of 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 and results are available more quickly.

Japan's JAXA Aerospace Agency Becomes the User of a RoboVib for Aerospace Applications

In March, Polytec Japan installed the first RoboVib Structural Test Station for aerospace applications at the Japan Aerospace Exploration Agency (JAXA). The RoboVib Station was delivered to the JAXA Chofu Aerospace Center in Tokyo and is intended for use by the Airframes and Structures Group of the Aerospace Research and Development Directorate. By utilizing specific measurement modules and data analysis software, the RoboVib Test Station works as a "Multi-axis Vibration Evaluating System (MaVES)". There are several important applications for MaVES including the characterization of aerodynamic models and small planes in wind tunnels, research on aeroelasticity, health monitoring, and vibration testing.

New RoboVib Applications Lab at Polytec USA

Inside the new Michigan office is Polytec's latest applications lab featuring a technically sophisticated Robovib Structural Test Station. In June, open house attendees were able to meet the Polytec Applications Team in person and to see the most advanced, automated, full-field 3-D vibration measurement system in action. The RoboVib has a linear traversing stage and is located in a dedicated, air conditioned room which has enough space to allow a companion robot for future applications.

More Info: www.robovib.us

RoboVib at JAXA Aerospace Agency

New Applications Lab in Dexter, Michigan

Polytec

Trade Shows and Conferences

Jan	19 – 22, 2011	SIAT 2011 Automotive Technology	Pune, India
Jan	23 – 27, 2011	MEMS 2011	Cancun, Mexico
Jan	31 – Feb 03, 2011	IMAC Conference on Structural Dynamics	Jacksonville, FL, USA
Feb	07 – 09, 2011	Photomechanics 2011	Brussels, Belgium
Mar	06 – 10, 2011	Smart Structures/NDE Conference	San Diego, CA, USA
Apr	04 – 08, 2011	Hannover Messe 2011	Hannover, Germany
Apr	27 – 29, 2011	EuroPACT 2011 Conference on Process Analytics	Glasgow, UK
May	02 – 05, 2011	AISTech 2011 Iron and Steel Technolongy	Indianapolis, IN, USA
May	03 – 05, 2011	CONTROL 2011 Quality Assurance Fair	Stuttgart, Germany
May	03 – 05, 2011	Interwire Trade Exposition	Atlanta, GA, USA
May	13 – 20, 2011	NIR 2011 Conference	Cape Town, South Africa
May	16 – 19, 2011	SAE 2011 Noise and Vibration	Grand Rapids, MI, USA
May	23 – 26, 2011	LASER – World of PHOTONICS 2011	Munich, Germany
June	07 – 09, 2011	Sensor & Test	Nuremberg, Germany
June	06 – Jul 02, 2011	METEC Metallurgical Technology Trade Fair	Düsseldorf, Germany
Jul	10 – 14, 2011	18. ICSV International Congress on Sound & Vibration	Rio de Janeiro, Brazil
Jul	16 – 22, 2011	11th Mechanics of Hearing	Williamstown, MA, USA

For the most up-to-date information and links on trade fairs, events and seminars, visit our web site, www.polytec.com.

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www.polytec.com/news

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