

VibroGo®

 Polytec



**Your VibroGo® travel guide**  
Measuring vibration, acoustics  
and dynamics on the go



„Everything  
in life is  
vibration.“

- Albert Einstein

**The heart beats, wings flap, insects generate sounds and receive a response – life would be much too quiet without vibrations.**

The investigation of vibrating systems in nature and technology requires a sensitive and flexible measurement technology that does not disturb the specimen. Here, as in technical systems, from bearings over gears to bigger machinery and industrial plants, non-contact laser vibrometry demonstrates the full range of its performance.

We have gone on expedition, searching for vibration phenomena and have found quite versatile examples for portable laser Doppler vibration measurement from Polytec in industry, research and development around the world.

VibroGo® is the truly portable, battery powered laser vibrometer for field studies and quick and easy condition monitoring of machines and facilities on the go.

VibroGo® measures vibrations on the go and without contact. This portable sensor detects noise and vibration and directly displays measurement data in the time and frequency domain. VibroGo® even allows on-board analysis in the field, while covering a wide frequency range of up to 320 kHz. Its outstanding resolution with high linearity across the entire frequency range provides a handy precision analysis tool. Use VibroGo® for a better understanding of dynamics and acoustics in nature and technology – for research, product development and quality assurance.

### The Polytec company

For more than 50 years and with nearly 500 employees worldwide Polytec develops, produces, and distributes optical measurement systems for research and industry. Our solutions cover vibration measurement, surface metrology, speed and length measurement, process analytics, machine vision as well as optical systems. Our customers obtain products and services through subsidiaries in Europe, North America and Asia and benefit from our worldwide service. Polytec has an excellent reputation thanks to its down-to-earth mentality, high-grade innovation and superior quality.



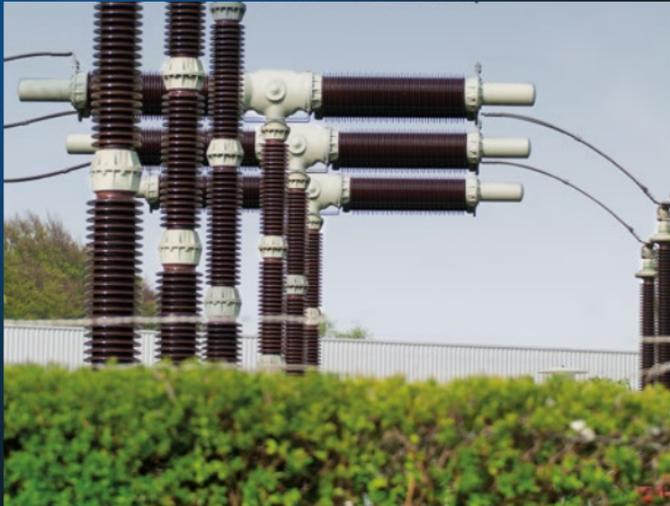
# Practical tips

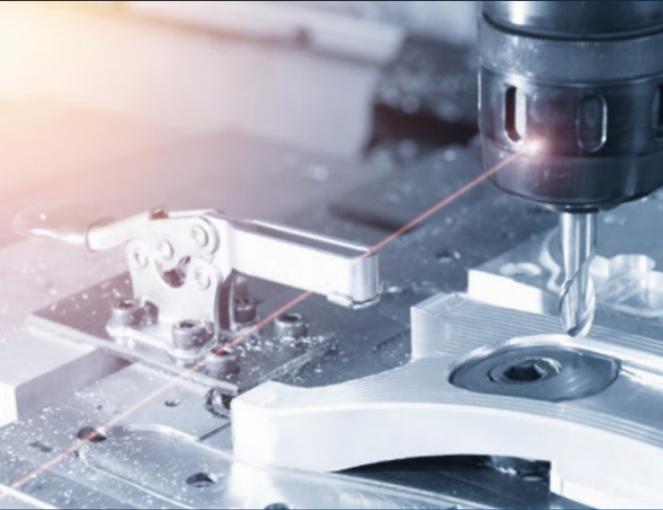
## Measuring sound, vibration and dynamics everywhere

*VibroGo® enables a reliable and precise vibration analysis, e.g. for condition monitoring, predictive maintenance of machinery, civil engineering studies and quality control.*



*Condition monitoring in the field at distances up to 30 m especially for hard-to-access areas or from safe distances.*





*Predictive maintenance of machinery, tools and installations in challenging industrial environments.*



*Non-contact vibration analysis without influencing sensitive or biological samples, e.g. studying insect communication and behaviour.*

**Let's go!**  
Discover the world  
with VibroGo®





**An exciting journey to the most interesting measurement areas around the globe begins.** Discover the world with Polytec's portable vibration measurement and explore the unknown.

# Highlights on the journey

Optical vibration measurement  
around the world



**USA**  
Understanding  
insect communication  
for pest control  
(S. 14-15)



**USA**  
Young researchers  
and explorers  
(S. 18-19)



**USA**  
Stand-off condition  
monitoring of the  
World Trade Center's  
structural integrity  
(S. 16-17)

**Germany**  
The ladie's  
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**Germany**  
Listening to the songs of cicades  
(S. 12-13)



**Japan**  
Quality inspections on old but gold precision parts  
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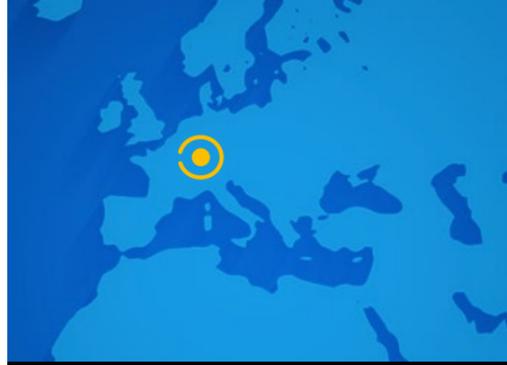
**France**  
Remote inspection in hazardous areas  
(S. 26-27)



**Switzerland**  
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## Listening to the songs of cicades





## Germany Baden-Wuerttemberg

- The planthopper (lat. *Hyalesthes obsoletus*) is a species, that represents a vector of a plant-disease in vineyards and therefore of scientific and economic interest.
- Cicadas, leafhoppers, planthoppers and spittlebugs (also called Auchenorrhyncha) are a very diverse group of animals within the insect world. Nevertheless, relatively little is known about their behavior and phylogeny. Vibrational signals play an important role in species recognition and mating behavior. Here, the use of laser vibrometer is extremely helpful.
- Laser vibrometer measurements and complementary microphone recordings show a clear vibrational signal from a male planthopper. The below signal shows simultaneously recorded airborne sound close to the animal, transmitted through the host plant.



## Understanding insect communication for pest control





The bacterium *Xylella fastidiosa* causes various serious diseases in a large number of crop plants. Among other things, the plant pathogen is responsible for a devastating disease in grape vines in California and South America, which costs the Californian economy alone around 104 million USD every year. In a unique research project, scientists analyzed the courtship communication of insects as vectors like the glossy

winged sharpshooter, a small cicada species measuring approximately 1 cm, with the aid of optical laser vibration measurement. They found a new method of pest control that has no adverse effects on the ecosystem, unlike existing measures such as the use of pesticides. This creates hope and optimism for farmers in Europe, where the bacterium has been spreading since 2013.



# Stand-off condition monitoring of the World Trade Center's structural integrity





USA New York

### How portable vibrometry kept the clearance crews safe

In order to protect the clearance crews during rescue operation of the World Trade Center on 9/11, building 4 was monitored with portable vibration sensors from Polytec. Professor Jim Sabatier's dynamic measurements were of great support of the assessment of the collapse hazard during rescue missions. See the reprinted original article by Dr. Sabatier, providing details about the metrological implementation of laser-based stand-off condition monitoring and vigilating the structural integrity.



## Young researchers and explorers





USA New Hampshire, University

**The program PolyLab was designed to empower today's students with the state-of-the-art tools for vibration measurement in the education sector, in universities or summer schools.**

The goal is to inspire and educate students and provide educational institutions, such as schools, colleges and universities, the ability to enhance their classes and laboratories by using the latest optical metrology techniques.



 **More information:**  
[www.polytec.com/polylab](http://www.polytec.com/polylab)

# Quality inspections on old but gold precision parts

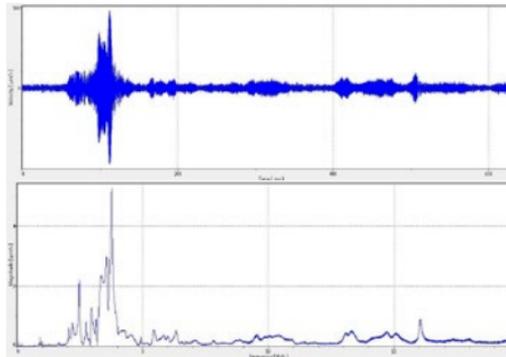




## Japan

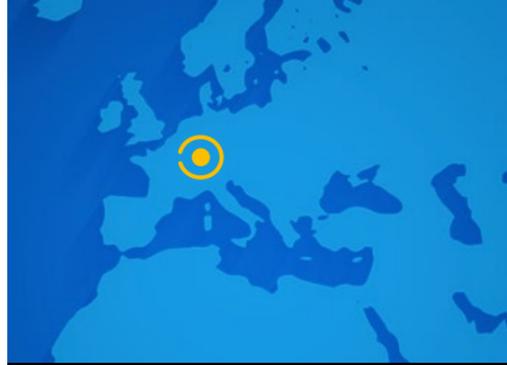
Have you ever lost important photos or documents due to a defective hard drive? We want all our data, personal or work-related, to be stored safely and reliably. Hard disk drives – with their ever growing storage densities and shorter access times – require an extremely high level of stability as regards the read/write head's positioning above the disk surface. Its flying height of just a few nanometers is a compromise between high data density and risk of collision. The resonances of the aerodynamic bearing depend on the ambient pressure and thus can cause instabilities.

Since laser vibrometers measure in a non-contact and non-intrusive way, they provide the only method of inspecting the response behaviour of the read/write head including its suspension following dynamic excitation as a function of the ambient pressure. Such resonance tests are used to identify critical conditions and then then derive design improvements to develop precision mechanics that respond robustly to resonances caused by aerodynamic excitation.



## The ladie's choice





## Germany

Vibrational signals are well-known to play a key role in mating (Hill, 2008) and even though many bee species are known to emit vibrational signals during mating, there are almost no studies on the function of these vibrations (Wcislo & Buchmann, 1995). Mason bees use thoracic vibrations in their precopulatory mating behavior before the female chooses a male (Seidelmann, 2001).

According to Peters (1978), there are two subspecies of the red mason bee in Europe – one on the borders of Europe (England, Skandinavia and Spain) and one in Central Europe. In Denmark, the two are supposed to overlap. Previous studies have already shown that German females prefer mating with German males over males from England.\* ►

**„I was really surprised that the 'simple' vibrations of this small bee contain so much information.“**



### **Dr. Taina Conrad**

Research Associate at University of Bayreuth, Germany

\* Source: Conrad et al 2015 - The role of vibrations in population divergence in the red mason bee, *Osmia bicornis*, *Current Biology*

# Vibrations of red mason bees

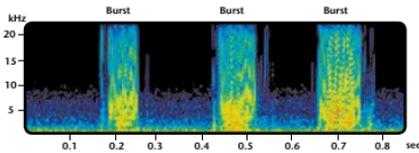
- 1 Is the female bee's choice influenced by the male vibrations?

Yes!

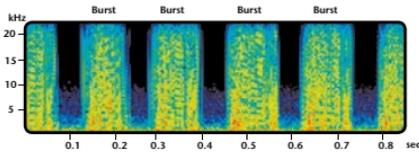
- 2 Do “dialects” and different “languages” within species and between species exist?

Yes!

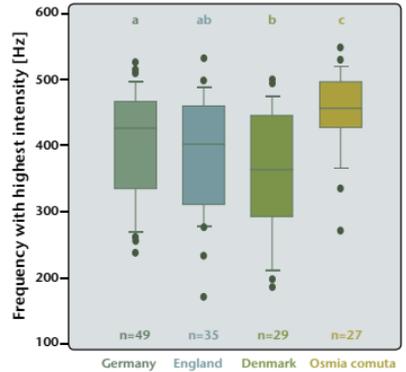
## Rejected



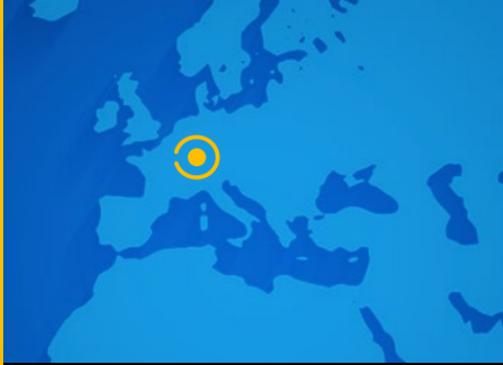
## Accepted



Females indeed use vibrations for female choice while choosing the male with longer vibration bursts (Conrad et al, 2010).

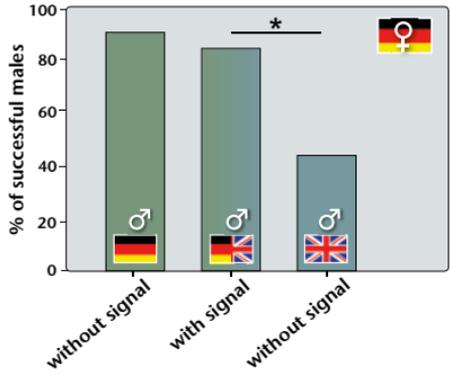
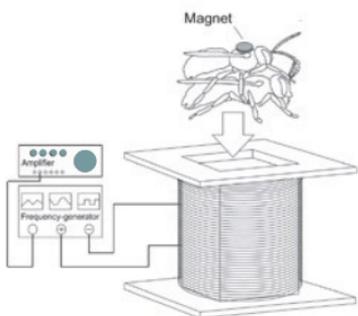


The thorax vibrations really express a species very specific communication and even differ between subspecies.



Germany

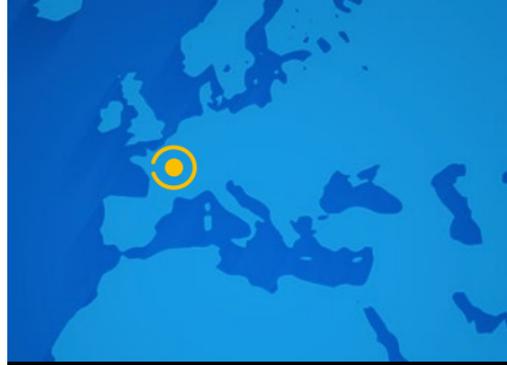
### 3 How does changing the male's vibrations influence the females' choice?



The bioassays clearly showed that the females do indeed use characteristic vibrational signals to distinguish between males from different countries. Changing the male's vibrations influences their choice.

## Remote inspection in hazardous areas





## France

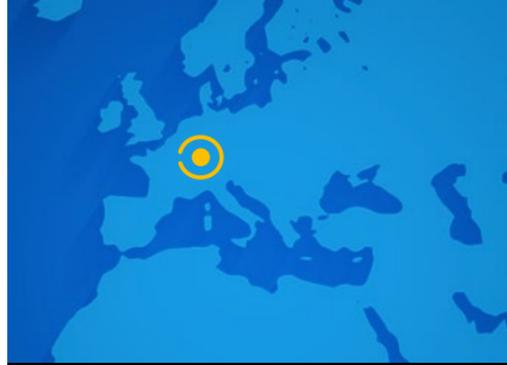
Access even for expert staff can be difficult when working in hazardous industrial environments. Here, the possibility of taking a very close look on test structures with a laser from a safe distance can be a crucial argument. Noise analysis e.g. on condensors, machine parts and more can be conducted with a VibroGo® portable laser vibration sensor. With environmental excitation through the wind, technical systems in the open space can reveal much about their condition. The detected movement of the structure under test is useful to study and check power plants or technical installations, look for loose parts or detached joints, worn gear wheels, pumps or fans and monitor condition, or indicate that maintenance or exchange is due.

- Measure structure-borne noise and vibration from a safe distance up to 30 m with a laser
- On-board data recording and analysis
- Detect vibro-acoustic signature on a large frequency bandwidth from DC to 320 kHz



## Preventive maintenance on bearings in opencast mining





## Germany Nordrhein-Westfalen

In opencast mining conveyor belts, some of which are kilometers long, move in conveyor roller garlands, which are made up of several idlers with roller bearings. Regular monitoring is already a challenge due to the dimensions and distances involved.

The bearings are exposed to dynamic loads, resulting in increasing wear over the period of use. A typical indication of wear is an increase in noise. Precise identification of the damage source is not possible with airborne sound measurements. By means of structure-borne sound measurements, the noises increasing near the bearings can be measured well. The spectral signature of the defect is transmitted to the measuring point, as the vibrometer is sensitive enough. Defective idlers can thus be identified. A final evaluation in the broadband frequency spectrum, which can

also be automated, then provides information about the condition of the bearings. The spectral signatures of good bearings and bearings with various degrees of damage are usually determined in preliminary tests on a test rig.

Condition monitoring, which has to be carried out in many places, should be done as quickly as possible. Therefore, the mobile application possibility is an important requirement here.



# Autonomous condition monitoring



© ANYBOTICS AG, Switzerland



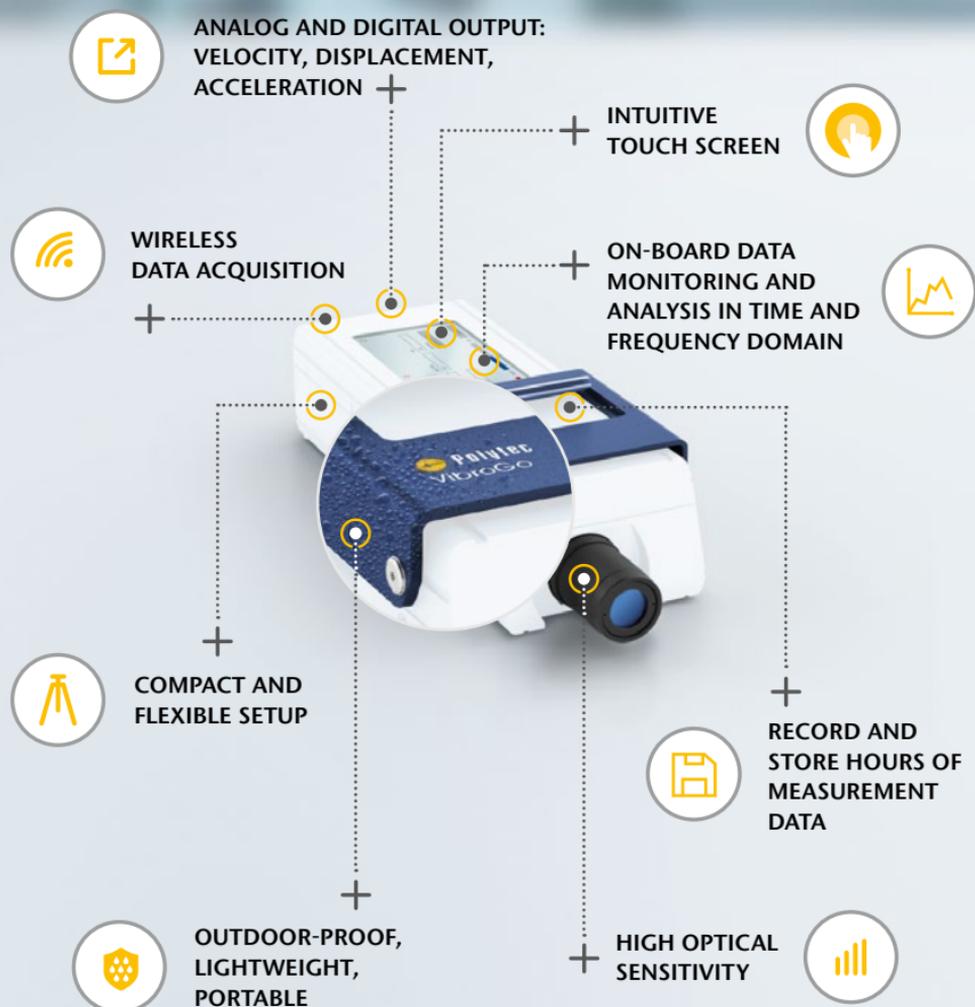
## Switzerland, Zurich

The autonomous robot ANYmal enters certain spaces, so humans don't need to. The ANYmal navigates independently through complex and even multi-story environments on dedicated missions. Once guided through the environment – often critical or hazardous – the robot remembers every detail and finds the fastest way to complete its task. During operation, the robotic system safely avoids obstacles and reliably moves over rough terrain.

This robot – depending on the installed sensors, metrology and other potential features – can determine operating conditions in confined or hazardous environments. Here, equipped with a portable laser vibration sensor, he inspects a roller mount in a narrow, dusty mining tunnel for abnormalities. Recording hours of measurement data, he brings home valuable insights for a subsequent processing and analysis.

# Your portable equipment

## VibroGo® at a glance





## Highlights

- Study acoustics and dynamics with laser precision in field and lab
- Easy to use, with touch screen and auto focus
- On-board storage, monitoring and quick analysis of measurement data
- Wireless measurement and remote control from everywhere within the advanced connectivity concept
- Lightweight, versatile and outdoor-proof (IP64)
- Measure from a safe distance up to 30 m, from DC up to 320 kHz
- Velocity range up to 6 m/s
- Displacement and acceleration available as additional output signals
- Analog and digital signal output
- Optional mobile power supply for up to 3 hours operation

## Point, shoot and measure

Vibration measurements made simple with VibroGo®: With auto and remote focus you can easily set up the laser beam on your test object and set the measurement range via touch screen. Directly retrieve the vibrational velocity, displacement and acceleration with the on-board data viewer. The integrated signal level indicator ensures the optimum operation. Select high pass and frequency bandwidth filters for clean signals. Thanks to the ASE Adaptive Signal Enhancement, VibroGo® measures reliably on any surface.

# Your portable equipment

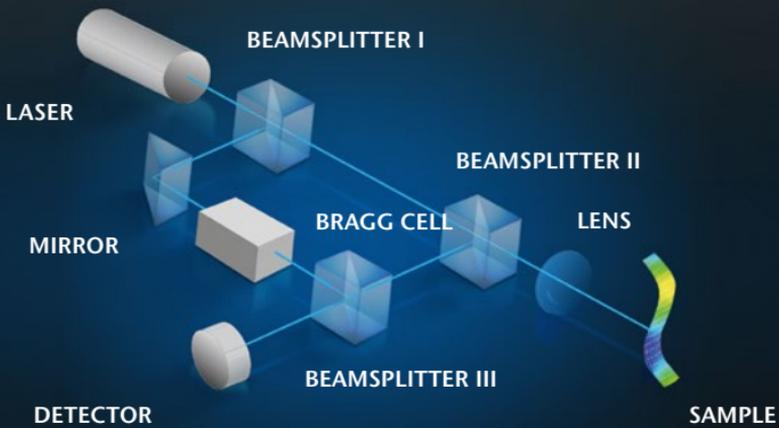
## VibroGo® at a glance



### A reliable tool for acoustics and dynamics

If you are looking for a portable, multi purpose and non-contact vibration sensor system, VibroGo® is the ideal solution. Use the lightweight tripod for fast setups. Stay independent with the mobile power supply for 3 hours operation time. Safely measure machinery vibrations on difficult to access or hazardous areas from a distance. Use Ethernet or wireless connection for measurement and remote control from everywhere, for comfortable sensor configuration as well as data transfer.

## LASER DOPPLER VIBROMETRY



### How it works

If a light beam is reflected by a moving object, the frequency of the light is shifted proportional to its velocity, a phenomenon referred to as the Doppler shift. Through this process, the velocity information becomes coded in the frequency of the light and is subsequently used by the laser Doppler vibrometry to measure the vibration. A precision interferometer and digital decoding electronics transform the frequency shift into a voltage signal that can be processed by standard data acquisition systems. A significant property of the technology, the velocity information is independent of the intensity of the reflected light; hence, the robust measuring principle works well even for objects with low reflectivity surfaces.



## Shaping the future since 1967

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