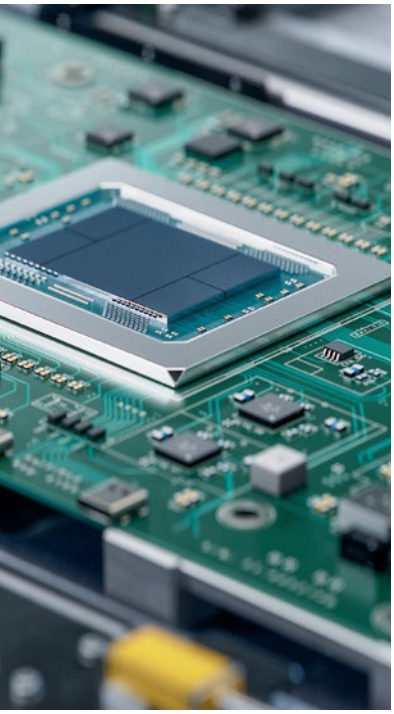
Polytec



Laser vibrometer for safe sensor technology

Non-contact shaker control

Application note

How current multi-channel vibration sensors are used to control shakers in vibration and fatigue testing

Imagine you are driving along a gravel road and the airbag deploys. A horror scenario that nobody wants to experience. Manufacturers therefore carry out extensive tests to prevent unwanted vibrations from reaching the actual sensor element in the control unit. Large shakers are used to apply controlled vibrations and shocks to the sensor system. With the introduction of multi-channel interferometry by Polytec (brand name QTec®), the shaker can now be precisely controlled to the vibration of the sensor component, such as an inertial MEMS sensor.

Real-time data for shaker control

The laser vibrometer provides non-reactive real-time data on the velocity, displacement or acceleration of the structure. This is particularly relevant on small structures such as sensor components on which no acceleration sensor can be used, or it would distort the vibration response. The measured data is fed into a feedback control loop to ensure that the excited vibrations are exactly to the desired specifications. The shaker control adjusts the amplitude, frequency and phase of the shaker movement to achieve the desired test conditions. The prerequisite is that the signal is continuous and does not contain any signal drop-outs that could interfere with the shaker control or even destroy the shaker.

Optimum shaker control only possible through precise positioning of the control sensor

Acceleration sensors are generally used as sensors for shaker control. They are attached to the sample fixture excited by the shaker and supply the control signal. The movement of the sample fixture is assumed to be uniform. This means that the same acceleration amplitude prevails at every point of the sample fixture. If this ideal case applies, the accelerometer also provides a good control signal.

However, series of measurements carried out in which the deflection of the sample fixture was recorded over an area at different excitation frequencies have shown that, for example, the displacement amplitude is not the same over the entire sample fixture under real conditions. It is therefore possible that the accelerometer records a different acceleration amplitude, frequency and phase than is actually applied to the sample under test or the component to be tested on a circuit board.

Compared to accelerometers, non-contact laser vibrometers offer the advantage that they can measure at any point, even directly on sensitive components such as sensors that are mounted on an excited circuit board. This results in ideal shaker control, as the control signal is recorded directly where the corresponding amplitude, phase and frequency must be present.

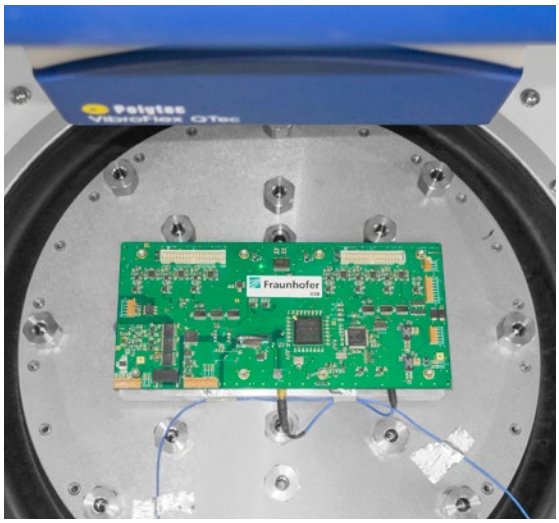
Uncompromising: drop-out safe, high resolution, quickly and where necessary

Thanks to QTec® multi-channel interferometry, users no longer have to worry about the surface treatment of the test specimen or possible drop-outs. This is because the QTec® multi-channel technology, used for the first time in laser vibrometers, scans the optical signal in parallel from different perspectives and eliminates signal drop-outs that could impair or, in the worst case, damage the control. For the user, there is no difference in handling or integration – except that the signal is stable thanks to QTec®.

Non-contact measurement technology is the best possible variant in terms of resolution and is even used to calibrate accelerometers. In addition, laser vibrometers can measure at almost any point. Both particularly large displacement amplitudes at low frequencies and extremely small displacement amplitudes at high frequencies of more than 2.5 MHz can be reliably recorded.

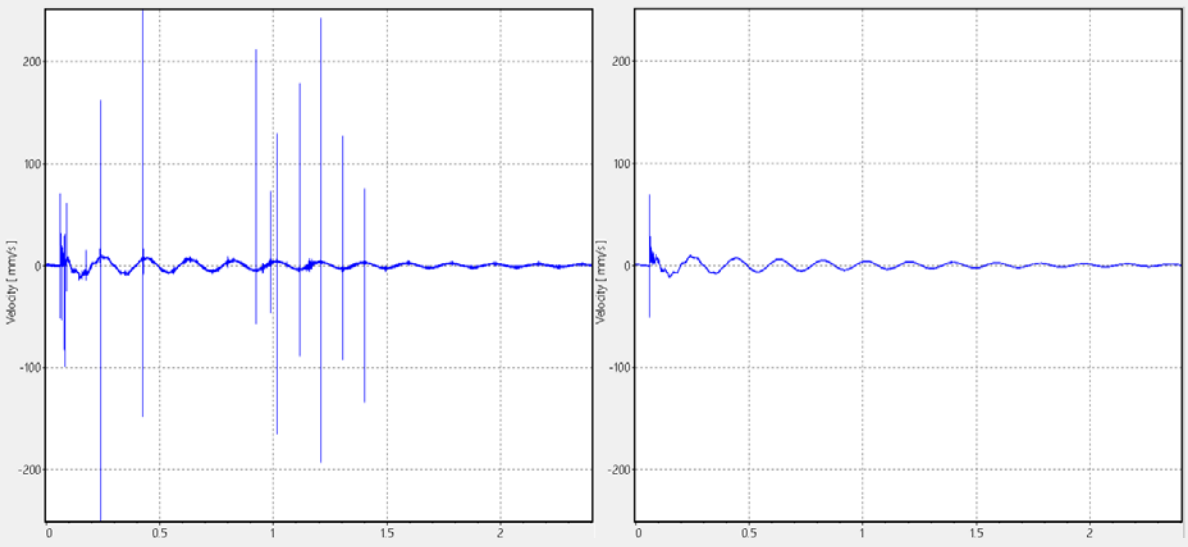
1
VibroFlex QTec®: shaker control for vibration testing of a power electronics at PID test & engineering GmbH.

2
Laser vibrometers provide feedback-free real-time data on the vibration response on power electronics – even on the smallest structures to which no acceleration sensor can be attached.

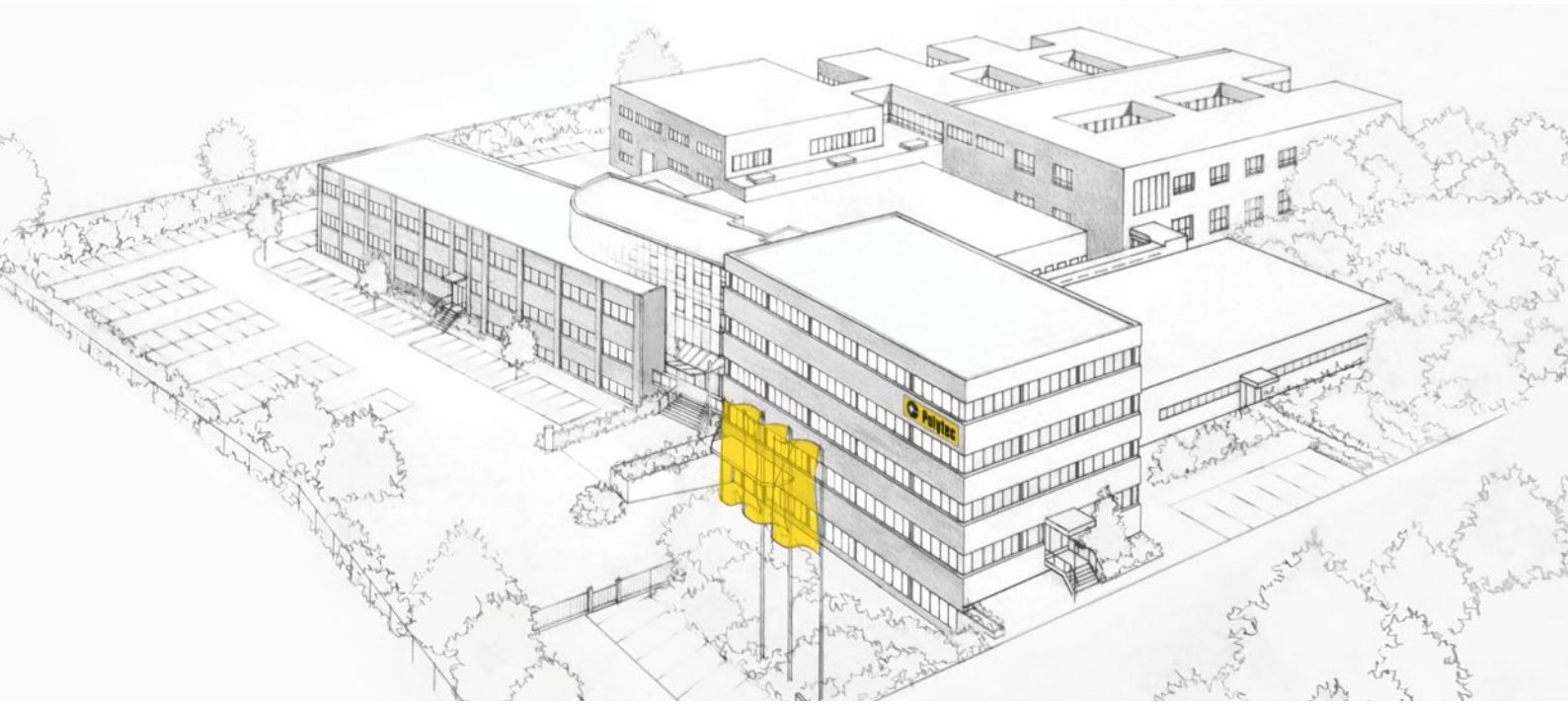


Vorteile

- **Contactless**
  Optimum positioning of the control sensor
- **Simple**
  No surface treatment of the sample
- **QTec®**
  No drop-outs or signal loss
- **Precise**
  High amplitude resolution
- **Flexible**
  High frequency and dynamic range



3
Time course of a vibration: on the left the signal of a conventional vibrometer with visible speckle peaks/signal drop-outs, on the right the signal of a QTec® multi-channel measuring system.



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2025/06 · Technical specifications are subject to change without notice.