

That Sounds Good



Non-Destructive Material Testing of Parts and Goods Using Vibration Analysis

Material testing using vibration analysis is an innovative approach to on-line quality control. It can be used anywhere that the vibration characteristics, and consequently the structure-born noise, are affected by differences in quality. Many defects can be detected using this approach including structural anomalies such as hairline cracks and cavities, density differences and general manufacturing errors.

Target: Cut Production Costs While Simultaneously Increasing Quality

In many industries the same quality inspection processes that were being used ten or more years ago are still being used today. These traditional processes are often subjective, evaluating surface effects and leaving the true defects hidden from the inspector. Consequently, false errors can happen, resulting in reduced or delayed production. In addition, many of these test processes are no longer cost effective and it is necessary to look for new and better methods of inspection. Vibro-acoustic or sound testing is a high performance, alternative tech

nique that must be considered for quality inspection applications. It is non-destructive and fast enough to provide 100% testing for products in an assembly line. Several industries where serial production of components is routinely done have implemented 100% inspection programs to meet the increasingly stringent customer performance and cost specifications. The dream of every plant operator is to reduce production costs and simultaneously increase the quality. In many cases these apparently contradictory targets can be pursued and achieved simultaneously by using test systems based on vibration analysis.

Transferring the solution from a development lab to a production line can be quite complex. It is particularly important to ensure that the introduction of this test procedure is within the technical capabilities of the factory employees. Worker acceptance of the quality test results is only attained if operating systems can be managed without intrusive specialists and without any complicated process changes, checks or obstacles.

MEDAV has many years of experience in this field and, today, offers fully automatic systems for vibration-based material testing. The new CrackMaster

System works as a “Black Box” in the manufacturing line, automatically compensating for unavoidable process influences. For example, adaptation to process drift is possible for many manufacturing processes.

The Experts are only Required Once – Setting up a Test System

Rigid bodies demonstrate structural vibrations which can be used for quality testing and inspection. These vibrations, to be more precise the natural deflection shapes, are specific to the component and are affected by the entire assembled product including joints, geometry, materials used, and production processes. Identical parts show the same vibration characteristics. On the other hand, subtle differences between parts affect the structure. For example, fractures and cavities, can lead to measureable deviations in the natural deflection shapes.

Consequently, it is a physically substantiated effect that is evaluated – an important difference when compared to many competing test procedures! There are several methods that can be used to determine the natural deflection shapes. Once these shapes

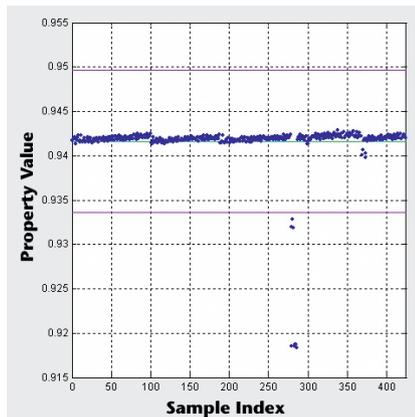


Figure 2: Notice the shift in the measured property over time. The saw-toothed progress corresponds to a change in the base material.

are known, the quality criteria are derived and a test specific to this component is put together (Figure 1).

The components are inserted into the test rig in the correct position and are made to vibrate by means of an impulse generator. Non-contact sensors are used in practice to measure the vibration: either traditional microphones measuring airborne noise or innovative laser vibrometers for non-contact measurement of structure-borne noise

The process fluctuations are determined for a representative time period from a random sample of parts acquired from running production. Under the assumption that the manufacturing process is running correctly, with the majority of the parts produced as good parts, the CrackMaster test system independently calculates the acceptability thresholds (Figure 2). If one or more of the properties of a component are beyond the acceptability thresholds, then the identified part is rejected.

The program automatically adapts the sorting thresholds over time because it is known that process drifts can affect the measurement enough to compromise the sorting criteria (good – bad difference) determined at an earlier point in time.

The Job of the Person Responsible for the Test

The test system helps to identify suspicious components in the processing chain and to reject them. But are the suspicious parts really bad parts and are the “typical” parts the good parts? These questions must be answered by factory test engineers running supplementary tests, such as tensile strength tests or ultrasound tests.

MEDAV provides the expert work by setting up the test system initially and training the staff in its operation.

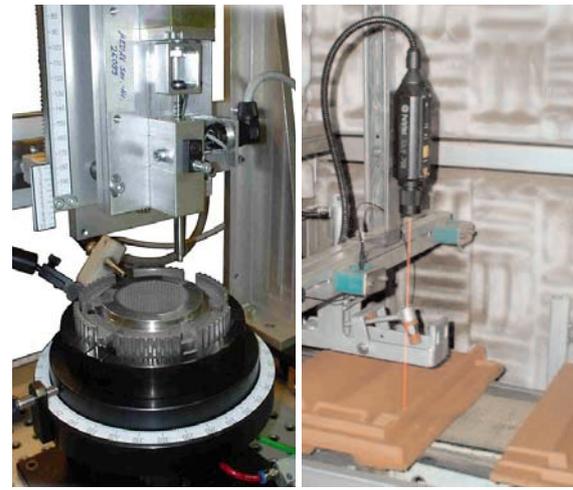


Figure 1: Examples of test rigs: 1) for a rotationally symmetric component with a microphone (on the left); 2) for a line-integrated roof tile test system with a laser vibrometer (on the right).

While on-line, the operator enjoys the “Black Box” and MEDAV enjoys the satisfied customer.

Applications for vibration-based material testing can be found in foundries, forges, glass and ceramics industries, pressing plants and many other areas.

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