INTELLIGENT ACOUSTIC MEASURING TECHNOLOGY FOR QUALITY ASSURANCE IN INDUSTRIAL MANUFACTURING
Continuous monitoring of manufacturing processes and product quality control are essential in industrial manufacturing to reduce machine downtime and scrap. To live up to the requirements of Industrie 4.0, automated production lines require methods for testing and inspecting that are capable of recognizing process irregularities and defective products automatically. With the expertise from many years of applied research in the field of intelligent acoustic measuring technology, Fraunhofer IDMT has developed various methods for quality assurance using airborne sound analysis. These methods are perfectly suited to be used for applications in which methods for optical measurement reach their limits.

**Unidirectional sound recording in noisy environments**

Industrial plants usually are characterized by a high level of noise. This makes it very difficult to effectively capture the sound produced by an individual machine or motor in order to monitor and assess the condition of moving or rotating parts. To solve this problem, the acoustics experts from Fraunhofer IDMT have developed methods allowing unidirectional sound recording. Depending on the given situation, either unidirectional microphones or microphone arrays can be used to record the desired sound. With the help of digital signal processing, it is possible to reduce noise and optimize the signal-to-noise ratio.

**Improving recordings using digital signal processing**

To extract the signal from the total of signal and noise, sound sources must be separated from each other. Alongside with classical methods for noise suppression, the Fraunhofer experts use methods for sound source separation known from the field of music analysis. By deploying additional microphones, ambient noise is recorded and later partialled out from the total of signal and noise. The result is a purified signal freed from the disturbing presence of noise.

**Competencies of Fraunhofer IDMT**

- Measurement of structure-borne and airborne sound, both in disturbed and non-disturbed environments
- Development of custom hardware and software for microphone arrays, including data preprocessing and data transfer
- Integration of sensorics with methods for synchronous data transfer
- Signal processing (single-channel and multi-channel) in networked systems and production facilities (including directional filtering, signal-noise separation, feature extraction, and acoustic fingerprinting)