



MICROSTRUCTURING AS PART OF THE NETWORKED ADAPTIVE PROCESS CHAIN

Task

As part of the High Performance Center »Networked Adaptive Production«, laser-based microstructuring is being integrated as a final step in a process chain for tools for automotive applications produced in lot sizes of one. Here, a distinction is made between two processes: faster ns- and more precise ps-structuring. During the production process, it is decided which process combination provides the best results – on the basis of important criteria such as machining time, costs and accuracy, surface roughness and the current machine condition.

Method

In addition to previously known processing criteria, real-time information about the machine and the process is of great importance for production. As part of the project, Fraunhofer ILT is developing a multi-sensor system that collects and analyzes the necessary data in order to enable users to detect defects and make decisions based on them in real time.

Results

The microstructuring plant was equipped with the multi-sensor system and for data acquisition with a hybrid FPGA- (field-programmable gate array) and PC-based monitoring system. The following data can be collected in real time:

Machine condition monitoring, data rate < 1 Hz - 10 kHz

- Temperature of the machine and environment
- Vibrations of the machine and environment
- Actual position of the machine axes
- Laser power and beam caustic

Process monitoring, data rate 100 kHz

- Actual positions of the scanner axes
- IR process emission
- VIS process emission
- Acoustic emission
- Reflection of the laser radiation

Applications

In addition to microstructuring with applications in the automotive, lighting and aerospace industries, other manufacturing processes can be integrated into I4.0 process chains in a similar manner. The real-time process monitoring system is also suitable for other scanner-based laser applications.

The project is being carried out as part of the Fraunhofer- and NRW-funded project »High Performance Center Networked, Adaptive Production«.

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- 3 Multi-sensor system for process monitoring.
4 Plant with integrated sensors and hybrid evaluation system.