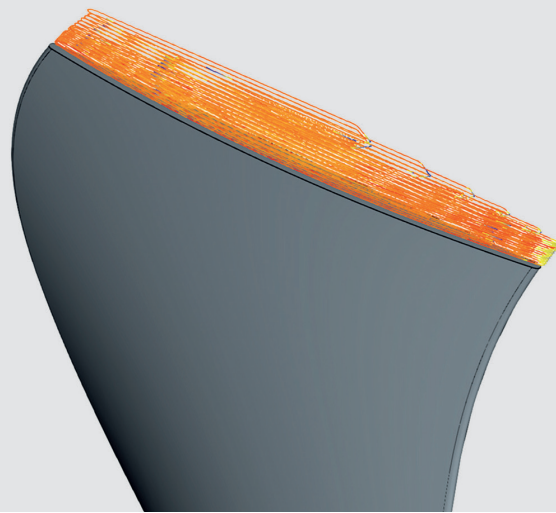# DIGITAL PROCESS SHADOW FOR LASER MATERIAL DEPOSITION

Task

In the Fraunhofer high-performance center »Networked, Adaptive Production«, Fraunhofer ILT is developing a digital process shadow for the laser material deposition (LMD) process. The process shadow is intended to provide a basis, using measurement data, for evaluating how to monitor and improve the LMD process. For this purpose, the institute has considered a systematic approach for the acquisition, processing and utilization of measurement data from process monitoring sensors and machine control.

Method

In a first step, suitable measurement data sources are selected. For the LMD process these are, on the one hand, measurement data from the machine control, material supply, laser beam source and peripherals and, on the other, sensor data from the laser beam/melt pool interaction zone (e.g. emitted heat radiation). These data are merged in a second step. Specifically, the emitted thermal radiation is measured with a pyrometer as a function of the LMD process control. The data of the machine control are collected using the standard machine communication protocol OPC UA.

Results

By merging tool-center-point (TCP) coordinates and pyrometer measurement data recorded online, Fraunhofer ILT is able to display measurement data geographically as well as chronologically. This means that the measurement data are no longer interpreted in a time-resolved manner, but also tracked in the component in a spatially resolved manner by assigning the actual TCP coordinates. This way, process irregularities or defects can be detected with spatial resolution. Other signals from the control system and systems connected via bus interfaces (laser beam source, powder conveyor, etc.) can also be used in this way. With this concept, a practice-oriented digital image of a process is created, providing reliable information for monitoring and improving the LMD process.

Applications

In the pilot line »Gas Turbine Blade Repair« of the high-performance center, Fraunhofer ILT has applied the concept presented here for the repair of turbine blade tips (tip repair) using LMD. In a next step, it will conduct research to determine which process and component defects can be tracked using the measurement data obtained. With the open communication standard OPC UA, the concept can be applied independently of machines, controls and applications.

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3+4 Digital process shadow
for a tip repair process.

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