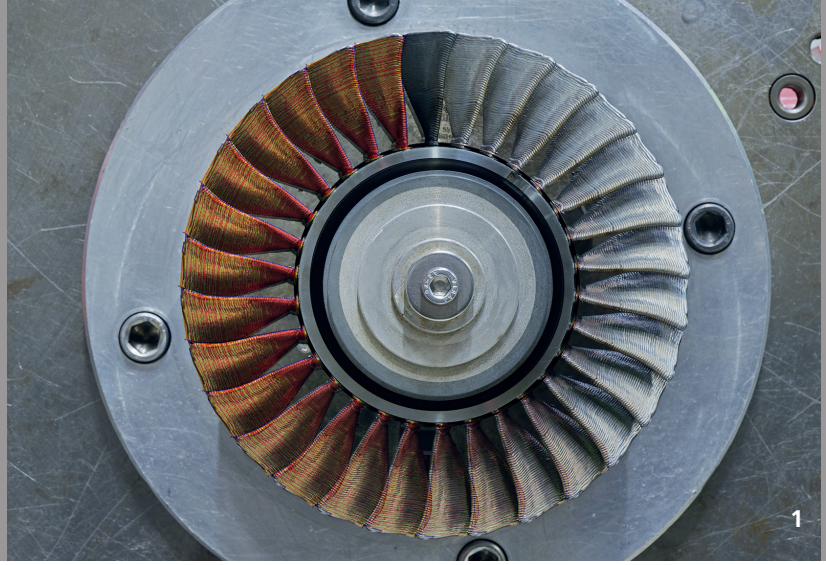

SPATIALLY RESOLVED PROCESS MONITORING FOR ADDITIVE MANUFACTURING WITH LASER MATERIAL DEPOSITION

Task

To qualify additively manufactured components, process monitoring is necessary to detect even the smallest deviations during the manufacturing process. In laser material deposition, coaxially integrated, camera-based sensors for detecting the thermal signature of the melt pool are state of the art. Data acquisition is predominantly time-resolved. The process monitoring data for individual component cross-sections are required, above all, with local resolution to enable users to localize process anomalies during the layered buildup of solids and to assign ex-situ detected component properties to in-situ recorded sensor signals for complex component geometries.

Method

A software solution developed at Fraunhofer ILT records and synchronizes not only the data of several sensors using a timestamp but also the tool center point coordinates of the machine tool, both of which make it possible to localize the measurement data. The machine data is recorded using the OPC UA standard. With an additionally implemented image processing pipeline, features extracted from melt pool images, such as the melt pool surface or detectable spatter, can also be recorded and localized in the component, in addition to pyrometer temperatures.

Results

By synchronizing different measured variables of the process monitoring with weld tracks of the laser material deposition process, Fraunhofer ILT has been able to investigate, in spatial resolution, a correlation of abnormalities in the images with quality characteristics such as volume defects and shape accuracies of the manufactured component.

Applications

The concept is currently being tested and validated on use cases from the aerospace industry. However, testing can be carried out independently of the industry for any use case in additive manufacturing, repair, component individualization or coating. With the open communication standard OPC UA, users can apply the data acquisition concept independently of machines and controllers.

Contact

Talu Ünal-Saewe M. Sc., Ext: -335
talu.uenal-saewe@ilt.fraunhofer.de

Dr. Thomas Schopphoven, Ext: -8107
thomas.schopphoven@ilt.fraunhofer.de

1 Hybrid-additively manufactured BLISK with representation of the process measurement data.