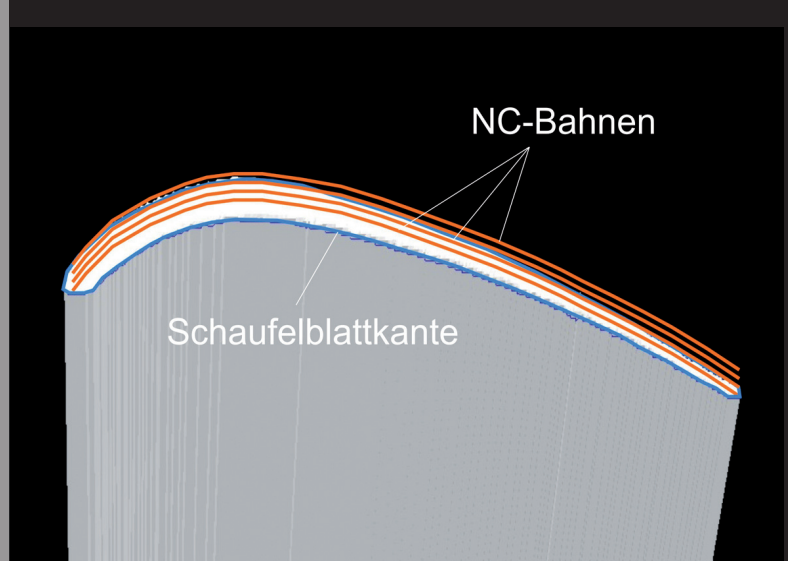


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## AUTOMATIC LASER CLADDING FOR TURBINE TIPS

### Task

Wear occurs at the tip of turbine and compressor blades during operation. This reduces the blade length and increases the flow losses. If the length undershoots a certain threshold, the blade must be taken out of service.

The missing volume on the helicopter engine blade tip processed in this project would previously have been restored by manually depositing material using TIG deposition welding. The welding and the necessary finishing are very time-consuming and hence costly.

Laser cladding represents an alternative process that facilitates automatic near-net shaped material deposition and hence reduces finishing time. Since the geometry of the blades varies, this repair process needs to be automated to efficiently utilize the laser cladding process and to ensure a high level of reproducibility.

### Method

The development of an automatic process chain tailored to the geometry of the turbine blade was broken down into the following working points: since the blade geometry varies, the actual geometry of each blade tip is recorded using a laser scanner. The scanned dataset is then analyzed and a center-point path on the blade tip calculated using a software module developed at Fraunhofer ILT. The points are fed into

the NC program for control purposes. During the process development of the technique, the course of the blade cladding and the process parameters are determined; the NC programs for automated control of the cladding process are generated based on this data.

### Result

The technique was implemented on a blade tip made out of a nickel-based material; near-net shaped laser deposition in line with specifications was achieved with an excess of 0.2 mm. The process parameters were successfully adapted to the blade width that varies along the turbine blade profile.

### Applications

This process is suitable for the automatic repair of blade tips on a host of blade types, e.g. from aerospace and power generation.

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3 Blade tip manufactured using laser cladding.

4 Digitized blade dataset with NC paths.