



»MULTI-BLIR« REPAIR WITH LASER METAL DEPOSITION

Task

For Laser Metal Deposition (LMD) to be used to repair components with complex geometries, process development requires time and depends, in particular, on the geometry and material of the component. In order to reduce the time significantly and react flexibly to changes in geometry, the Innovation Cluster »AdaM« (Adaptive Production for Resource Efficiency in Energy Generation and Mobility) has, in part, focused on developing an LMD technology processor. It is based on experimental results from LMD, which are stored in a database, and a simulation tool. To illustrate the experimental results, process diagrams have been developed. With the example of a multistage, blade-integrated rotor segment (»Multi-BLIR« segment), a blade tip repair process shall be demonstrated.

Method

The CAM software »LMDCAM2 « developed at Fraunhofer ILT can be used to compare the measured actual blade tip geometry to the target geometry. Then, the difference in volume to be built is determined and cut into several layers (Figure 1). Supporting points are created along the blade profile per layer. Here, at each supporting point, process parameters – which are determined from process diagrams – are adapted to the local blade geometry (laser beam diameter, laser power and scanning speed for a selected powder mass flow).

- Tool paths created with »LMDCAM2« for blade tip repair.
 Result of the blade tip repair
- of a »Multi-BLIR« segment.

Result

Using this approach and its CAM tool, Fraunhofer ILT has demonstrated that a blade tip of a »Multi-BLIR« segment could be successfully repaired when the parameters are adapted to the geometry (Figure 2). As a result, the time and effort needed for the LMD process development of blade repairs can be reduced significantly so that only small adjustments to the process parameters are required.

Applications

The concept behind the LMD technology processor and the process diagrams can, in principle, be used for all repair applications. Especially turbomachinery construction and mechanical engineering can profit from this development.

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