

Boosting productivity through adaptive process control in metal 3D printing

Productivity versus quality: an unresolved conflict

When laser powder bed fusion (LPBF) is used for manufacturing, the industry faces a fundamental dilemma: It can increase productivity, but component quality almost inevitably suffers – for example greater porosity or higher surface roughness. And yet, to be economically viable, LPBF processes need to build components at a higher build rate. This is particularly the case for small and medium-sized enterprises (SMEs), which often do not have access to expensive multi-laser equipment. In current LPBF practice, the entire component is manufactured using largely uniform parameters, regardless of geometric differences within the component. This prevents local optimization and wastes potential.

Process intelligence instead of hardware upgrades: adaptive LPBF process control

In the "flexPBF" research project, a novel, software-based approach was developed to significantly increase productivity in LPBF – without any changes to the system technology. Since the system can automatically detect geometric features, components are virtually divided into geometrically different »features,« which are differentiated with adapted process

parameters (e.g., track spacing, layer thickness). Planning takes place in a newly created CAM environment, which transfers the generated path data to the LPBF system via flexible interfaces. The process control, thus, adapts adaptively to the geometry – fully automated and transparent for the user.

Productivity gains for SMEs without compromising quality

The productivity increased by over 50 percent in the project while maintaining consistent component quality, an innovation that shows the concept works. SMEs in particular will be able to use existing LPBF systems more economically in the future with the adaptive LPBF process control and benefit from significantly shorter construction times, for example in toolmaking, medical technology, or aerospace.

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Demonstrator components for adaptive LPBF process control.