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# Geometry Adaptive Processing Strategies for Laser Powder Bed Fusion

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In the Laser Powder Bed Fusion (LPBF) process, metallic components are manufactured layer by layer by selectively melting metal powder using laser radiation. While the additive manufacturing principle allows parts ofalmost unlimited complexity to be produced, LPBF process control strategies are largely static according to the state of the art and only take into account the component geometry to be manufactured to a limited extent. In practice, this results in locallyvarying process conditions with deficits in component quality, process robustness, restrictions in design freedom such as the need for support structures and a relatively low build-up rate. Using the example of the titanium alloy TiAl6V4, the deficits of conventionalLPBF process control are shown in the present work and an adaptive LPBF process control is developed on this basis, in which the LPBF process parameters, such as the laser power, are adapted locally for specific geometries. The adaptive LPBF process controlavoids local material elevations and undesirable deviations in the melt pool dimensions without changes to the system hardware, produces test specimens with overhang angles of up to 10° without supports and increases the real build-up rate by over 20 %. Inaddition, the adaptations to the system and control technology required for adaptive LPBF process control are identified and implemented. The transferability of adaptive LPBF process control to complex components is demonstrated by developing a software demonstratorfor generating the build data.

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