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# An approach for distortion compensation for the manufacturing of complex parts via Laser Powder Bed Fusion

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**Abstract**
Many industries have already incorporated additive manufacturing (AM) technologies, such as Laser-Powder Bed Fusion (L-PBF) into their production chain. One of the limiting factors for the widespread industrial usage of L-PBF is the geometric deformation of final parts after manufacturing. Even though some approaches, such as the pre-heating of the build chamber or the heat treatment before part removal can limit part stresses and subsequent distortions, final dimensions of the printed parts can differ from the original nominal computer aided design (CAD) models. Users of AM technologies combat these distortions by increasing allowances for final machining or iteratively adjusting the design in order to meet part requirements. These workarounds reduce economic feasibility due to increased material consumption, labour-intensive manual CAD corrections, or multiple build jobs required. Therefore, an efficient solution for the distortion compensation needs to be developed for complex parts and a diverse machine tool environment. The objective of this research is to analyse the effectiveness of a reverse engineering (RE) based approach. Therefore, three high-impact use cases are selected and manufactured on an L-PBF machine tool using the distortion-prone Ti6Al4V as powder material. After initial fabrication, the part geometry is scanned and transferred into a standard tessellation language (STL) file. Using reverse engineering software from Zeiss, Oberkochen, Germany, the deviations of the STL files from the nominal CAD files are analysed and new CAD files with corrected and compensated geometric dimensions are created. In a second fabrication run with the new CAD models, the effectiveness of this RE compensation workflow is analysed via the deviation analysis using scans of the manufactured parts and the nominal CAD file.

additive manufacturing, L-PBF, Ti6Al4V, distortion