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Layer-wise powder deposition defect detection in additive manufacturing

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Abstract

Additive manufacturing applications, in areas such as aerospace and medicine, are limited due to the lack of process stability and quality management. In particular, geometrical inaccuracies and the presence of mechanical defects hinder repeatability of the process¹. A great disadvantage of AM is that verifying the quality of AM produced parts are mainly done after part fabrication which does not allow the operator to act upon defects observed during the actual build. To break into industries with very high quality standards, an important issue to be addressed is in-situ quality control during a build^{2, 3}. If defects on a new powder layer can be detected before laser melting occurs, a new layer may be suitably recoated or the process can be paused for user controlled rectification. The work which will be presented here is focused on image based process monitoring of a powder bed additive manufacturing system using a shadow casting method. As a proof of principle, a few main defects during recoating will be identified and analyzed to establish the severity and possible impact of the defects on metal powder consolidation. Preliminary results of defects identified before and after material consolidation will be shown. For this, a software package is in development to automatically detect defects. This is aimed towards developing a system which in the future will contribute to quality assurance.