

# Numerical Analysis of Support Structures' Removal from Additively Manufactured Components

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## ABSTRACT

The finite element analysis (FEA) of components' build-up has recently proved to be a valuable tool for accompanying the product and process development during additive manufacturing (AM). In this numerical method a first key aspect is the heat input modelling of laser scanning for building-up AM products of industrial relevance, as close to reality as possible, by applying equivalent heat source models [1]. Based on these reduction models the stress distribution in a successive thermo-mechanical simulation is calculated approximating the sum of thermal, elastic and plastic stresses during processing and the remaining elastic and plastic stresses after cooling [2]. A further key aspect is, thereupon, to predict the final shape of the additively manufactured component by means of the FEA after its removal from the substrate or the support structures [1,3]. This work aims to analyze the development of stresses in components during their additive laser processing and cooling to ambient temperature as well as after post-processing cutting operations. Moreover, the associated to stress development simulated final part shape is evaluated with the aid of 3d measurements on an additively manufactured twin cantilever of industrial relevance. Finally, based on the rendered simulation results a compensation of the undesired shape distortions is proposed based on reverse engineering approach [4].

**Keywords:** *Selective Laser Melting, Finite Element Analysis, Simulation of Stresses, Simulation of Shape Distortion, Post-processing Cutting Operations, Elastic Recovery, Shape Distortion Compensation*

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