

УДК 681.51

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OVERVIEW OF MODERN-DAY CAD/CAM/CAE SOFTWARE CAPABILITIES FOR METAL ADDITIVE MANUFACTURING SIMULATION

Additive manufacturing technology has been evolving constantly since 1980. Currently additive manufacturing is applied in a huge number of industries [1]. The process of additive manufacturing, also known as 3D printing, can be described as continuous fusion or bonding of different materials (such as plastic, metal, alloy or mix of different substances) in layers that will result in desired

layering part production. Recent advancements [2] brought this technique to a more widespread use beyond just prototyping but straight to industrial applications. However, a lot of challenges still do exist in front of 3D printing technology before it will be able to fully replace traditional manufacturing technologies.

Nowadays industry offers a fairly wide range of metal 3D printing techniques to choose from. It has an advantage over traditional manufacturing processes in speed, flexibility, automation and reduced production cost [3]. To optimize and create better solutions for the manufacturing process, to avoid build failure, etc. simulation software was developed.

Modern-day CAD/CAM/CAE software for metal additive manufacturing must include 5 steps that will be able to help to determine necessary actions for obtaining needed end-result.

Such steps can be defined as:

1. the input of geometry;
2. topology optimization;
3. geometry manipulation;
4. thermal analysis;
5. structural analysis.

Each step contains in itself different needed solutions for future successful implementation of the 3D printing process. Firstly, previously defined geometry must be created in simulation software or imported from an already created STL file. The topology optimization process helps to reduce the weight of the manufactured part and increase energy efficiency. Optimized detail further needs to be observed for geometry improvement. After obtaining the necessary geometric parameters, it is necessary to conduct a thermal analysis to understand the heat distribution. Based on the data of thermal analysis a structural analysis is carried out to determine residual stresses, performance, and durability of manufactured detail.

Five determined steps of additive manufacturing simulation process can be found in modern-day CAD/CAM/CAE software for metal additive manufacturing simulation as Ansys, Abaqus, SimScale. It will help to increase automation, reduce the cost of manufacturing, confirm the applicability of manufactured parts based on structural analysis data, increase the speed of the printing process.

Optimization of created steps, improvement of different standalone processes of metal additive simulation can help to ease the manufacturing process and make 3D printing metal technology availability more widespread not only for big companies but also for private customers.

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