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Design principles for structural components and functional devices

Frank Schubert, Bernd Schob, Camilo Zopp and **Lothar Kroll**
Chemnitz University of Technology, Germany

The technology of Selective Laser Melting (SLM) is capable of generating high-performance lightweight parts featuring an outstanding geometrical complexity. Due to the time and cost intensive production method, special design strategies are required for reaching highest economic efficiency along the entire process chain. To achieve AM designs for many different parts, it is useful to apply category-related design principles. Fist strategy is mainly based on numerical topology optimizations as well as a sufficient interpretation of calculated results. This approach is suitable for structural components featuring predefined bearing positions as well as strength and stiffness requirements. By increasing geometrical complexity and design freedom of AM parts, this approach needs to be extended significantly. It is useful to divide the desired part into functional sub-components. After numerical optimization of every single element, they need to be positioned and interconnected by considering process chain limitations and operational use requirements. The presentation will show through suitable examples the application of both design principles. For AM-related interpretation of topology optimization results, a generic bracket demonstrator will serve. The design strategy for functional devices will be examined by a hydraulic valve block for aerospace applications. Furthermore, support reductions strategies as well as hybrid design approaches will be discussed.

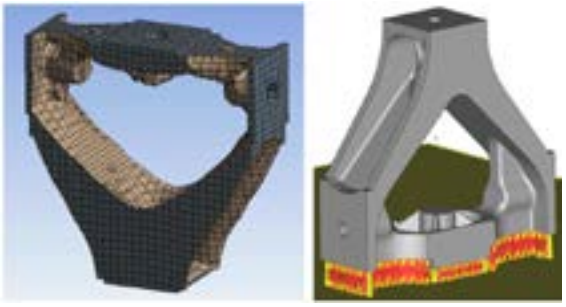

Figure 1: *Topologically optimized geometry (left) and derived AM component (right).*

Figure 2: *Positioned sub-compoments (left) and manufactured AM device (right).*

Biography

Frank Schubert studied Mechanical Engineering at Technische Universität Dresden, Germany. Since 2010, he is the Head of Additive Manufacturing at the Institute of Lightweight Structures, Technische Universität Chemnitz, Germany. His research intererest includes: additive manufacturing of high performance alloys, design guidelines and AM related process chains. The Additive Manufacturing research team is focusing on processing of new metal alloys. In cooperation with industrial partners, the achieved basic results are transferred into applications. One selected example for a successful collaboration is the 3D printed spoiler actuator manifold of Airbus A380. Since March 2017, this flight-safety relevant component is operating in A380 test aircraft.

frschu@hrz.tu-chemnitz.de

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