

Topology optimization and additive manufacturing

The finite element based topology optimization is a powerful tool to design products with optimal material usage. Within a defined design space material will only remain in regions where material is needed to comply with the constraints and the target function.

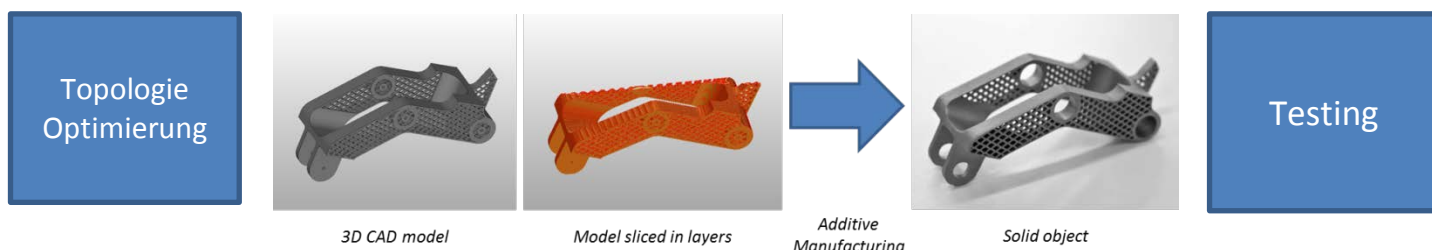
Selective laser melting is an additive manufacturing (AM) technology based on the layer by layer generation of complex structures without any tools or molds. It represents the most efficient way to realize topology optimized structures.

The combination of topology optimization and selective laser melting is highly effective to make parts lightweight, increase strength, change natural frequency, reduce reaction forces or even to increase fatigue resistance.

In addition to the development and production process the proof the results by physical testing is crucial. A wide range of test methods may be offered by ZPP or in cooperation with our internal partners at ZHAW.

Advantages

- Optimize material usage
- Optimize weight, strength and other structural properties of parts and assemblies
- Integration of function
- Reduce time-to-market
- Develop fail-safe products of higher durability

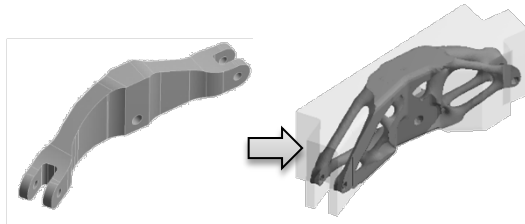


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Examples

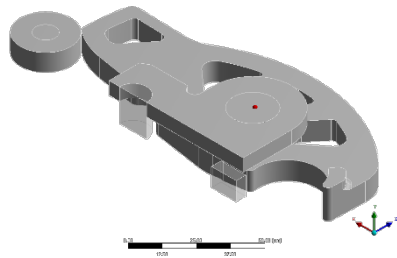


Lever

Reduced stress, reduced mass (-21%) by higher stiffness (+35%)

Source: Additive Technologiemanagement

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Press tool

Reduced stress, higher stiffness +40%



Gear-wheel

Functional integration (internal cooling)



Galley attachment

Topology optimized and additive manufactured

Process

Structural Optimization

- Initial Design
- Space Geometry
- Finite Element Model
- Optimization Model
- Topology Optimization
- Smoothing
- Validation Simulation and Verification
- Structural Optimized Geometry

Additive Manufacturing

- Preparation
- Layering
- Processing data to machine
- Laser melting
- Post processing part

Testing

- Preparation
- Validation
- Evaluation