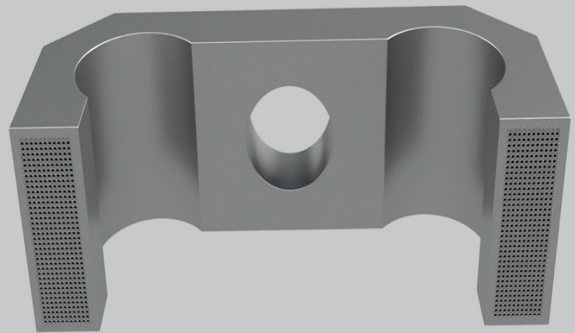


1 cm

1



5 mm

2

WEIGHT REDUCTION OF AIRCRAFT COMPONENTS BY TOPOLOGY OPTIMIZATION OR LATTICE STRUCTURES

Task

For the aerospace industry in particular, reducing the weight of components is of great importance to achieve significant economic and environmental improvements. At the same time, the strict quality requirements, for example with regard to the mechanical properties, must be maintained.

As part of the »EMUSIC« project, Fraunhofer ILT will investigate the topic of weight reduction of aerospace components by using topology optimization or integration of lattice structures. The components are manufactured using the additive laser production process laser powder bed fusion (LPBF), which allows great design freedom.

Method

The load acting on the component is fundamental to topology optimization since it determines the distribution of forces (strain) in the component. In places with low force effects, less material is needed. Through iterative simulation (ABAQUS) steps, material is gradually removed until only the structures relevant for the function remain. The design guidelines for the LPBF process (minimum resolvable structures or maximum overhang angles) are taken into account.

1 *Topology-optimized component.*

2 *Sectioned component with internal lattice structures.*

The second approach is based on leaving the outer geometry of the component as is, but replacing the volume in which the effective force is low with lattice structures. With the institute's own Grasshopper plug-in, the CAD model is furnished with an internal lattice structure in order to achieve an optimal result. This method also leads to a significant reduction in the weight of the component.

Results

Two demonstrators were produced with a weight reduction of at least 30 percent each. Currently, these are being examined for their mechanical strength and compared with conventionally manufactured components.

Applications

Apart from use in the aerospace industry, the methods presented here are also suitable for weight reduction of components from other industries.

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