Motivation

Repairing damaged or consumed parts is always a problem for both, customers and/or the manufacturing and repair services companies. Replacing parts is not always cost or time effective, therefore repairing the parts and extending its life is the best solution for reliable operation of machines. But the question is how to do this maintenance in easy, short time, accurate, in work field workshops and even by the customer himself? Introducing SLM in machine elements commercial production and repair is a big challenge, and it is a great study field, which may be the key solution to achieve the above goals in future, and to go further in integrating some features to parts or design more complex geometries that is impossible to achieve by other manufacturing processes.


Ziel

To contribute SLM technology fully or partially within machine elements manufacturing and repair by validating the process and proving it as cost-effective. Optimize the design of the manufactured or repaired parts in a way that it will be able to carry out the applied dynamic loads. And to integrate functions to the parts in the same building process which present the benefit of using this method and its ability to be competitive with the traditional manufacturing methods.

Wissenschaftliche Herausforderungen

The challenges that prevent using SLM in manufacturing or repair parts that subjected to dynamic loads are the limited understanding of the material properties, limited size of the produced parts, surface tribology and dynamic loads. The first scientific challenge in this research is how to get a homogeneous interface surface for the repaired part between original and sintered partition. And to find a suitable printing direction that give best static and dynamic characteristics for the part. The second challenge is to integrate functions to some study parts to improve functionality directly without the need for further components,
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Design 2016
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Vorgehensweise

Validating the mechanical properties of the material.
Dividing the printing process to more than one operation process.
Printing material alloy over other material alloy from the same material base or from two different material base alloys.
Producing hollow parts with supporting internal structures.
Producing parts with features from two different alloys of the same base material.
Completing repair work for a car wheel carrier.

Ausblick

Investigate the effects of different laser parameters by SLM machine. Microstructural analysis, fatigue and tensile tests will be performed to provide the required material characteristics. And this will provide the data for modelling.
A case study part will be used to validate SLM for machine elements, this study part contains difficult-to-manufacture features and functions, and it will be constructed by using one material and with two materials.
A process modelling using analytical simulation method FEM and mechanical techniques will be performed. Then the case study part will be tested by using a dynamic test bench.
Develop the model by optimizing