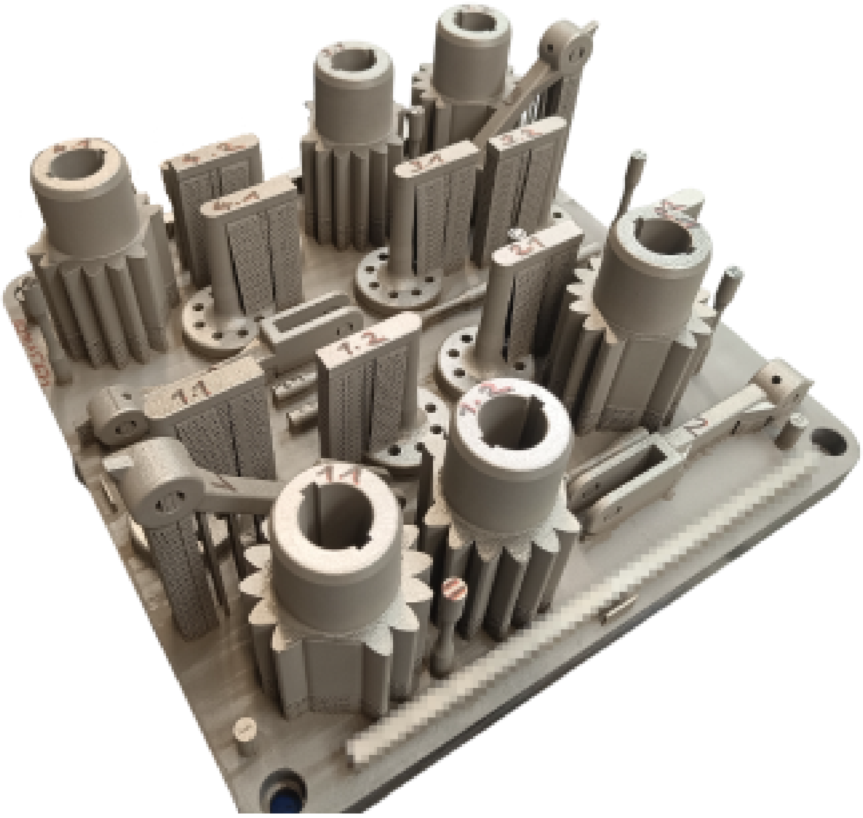
Optimising additive manufacturing of metal components: with digital models

About this project



BUENA

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Markets:

Material: Steel

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About this project

This project is funded by the Technology Transfer Programme Leichtbau (TTP LB) of the Federal Ministry of Economics and Energy.

Technology Transfer Program Leichtbau

Context

The additive manufacturing of metal components offers great potential for lightweight construction. It enables complex, functionally integrated structures, saves material and shortens development times - especially for small series. Despite these advantages, the technology has not yet established itself on an industrial scale. This is due to insufficient process stability, fluctuating component quality and high testing costs. These factors make economical and energy-efficient production difficult.

There is also a lack of common standards for quality certification and approval of additively manufactured metal components. Ecological assessments are also lagging behind: although additively manufactured parts save material and weight, powder production and energy requirements in manufacturing are high. In order to assess the actual climate benefit, cost and CO# balances must be recorded over the entire life cycle.

This is precisely where the researchers in the BUENA project come in. They are investigating how the additive manufacturing of metal components can be transformed into stable, economical and resource-saving series production.

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Purpose

The project team is developing solutions to transfer additive manufacturing for metallic components into series production across all industries. The focus is on stable processes, reproducible quality and a measurable reduction in CO# over the entire life cycle.

To this end, the scientists are developing models that incorporate cost and emissions data into the development process at an early stage. In future, it should be possible to estimate how a component will perform in production and use as early as the design stage - both technically and ecologically.

Another focus is on digital quality assurance: a digital twin is to derive the mechanical properties of a component from real process data and serve as proof for approval. At the same time, the researchers are developing methods to achieve the "first-time-right" principle - in other words, components that are produced without defects at the first attempt.

Procedure

The researchers first analyse the factors influencing process stability. They record the quality of the starting materials, analyse powder properties and monitor production using sensors. Based on this data, models are created that link process states and component properties.

Machine learning helps to recognise deviations at an early stage and correct the manufacturing process in real time. In addition, the scientists are developing methods for non-destructive testing in order to provide proof of quality more quickly and cost-effectively.

The central basis is a digital platform on which all data, models and results converge and the project partners can simulate, compare and evaluate processes. At the same time, component demonstrators from various industries are being created, which the team is using to test and further develop its approaches in practice.

This creates a consistent data structure that links development, production and testing more closely together and facilitates the industrial application of additive manufacturing.

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Funding duration:

Funding sign:	03LB2047	**Funding amount:**	EUR 2.8 million

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2047A - BUENA in the federal funding catalogue

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Project coordination

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English (EN){{ Projektpartner }}

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Lightweighting classification

	Realisation
Offer	
Products Parts and components, Machines and plants, Software & databases, Systems and end products, Materials	✓
Services & consulting Testing and trials, Prototyping, Simulation	✓
Field of technology	
Design & layout Lightweight manufacturing	✓
Functional integration	
Measuring and testing technology Environmental simulation, Materials analysis, Destructive analysis, Non-destructive analysis	✓
Modelling and simulation Loads & stress, Life-cycle analysis, Optimisation, Processes, Structural mechanics, Materials, Reliability validation	✓
Plant construction & automation Plant construction	✓
Recycling technologies	

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Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing Deposition welding, Selective laser melting (SLM, LPBF, ...)	✓
Coating (surface engineering)	
Fibre composite technology	
Forming	
Joining	
Material property alteration Heat treatment	✓
Primary forming	
Processing and separating	
Textile technology	
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites	
Fibres	
Functional materials	
Metals Steel	✓
Plastics	
Structural ceramics	
(Technical) textiles	