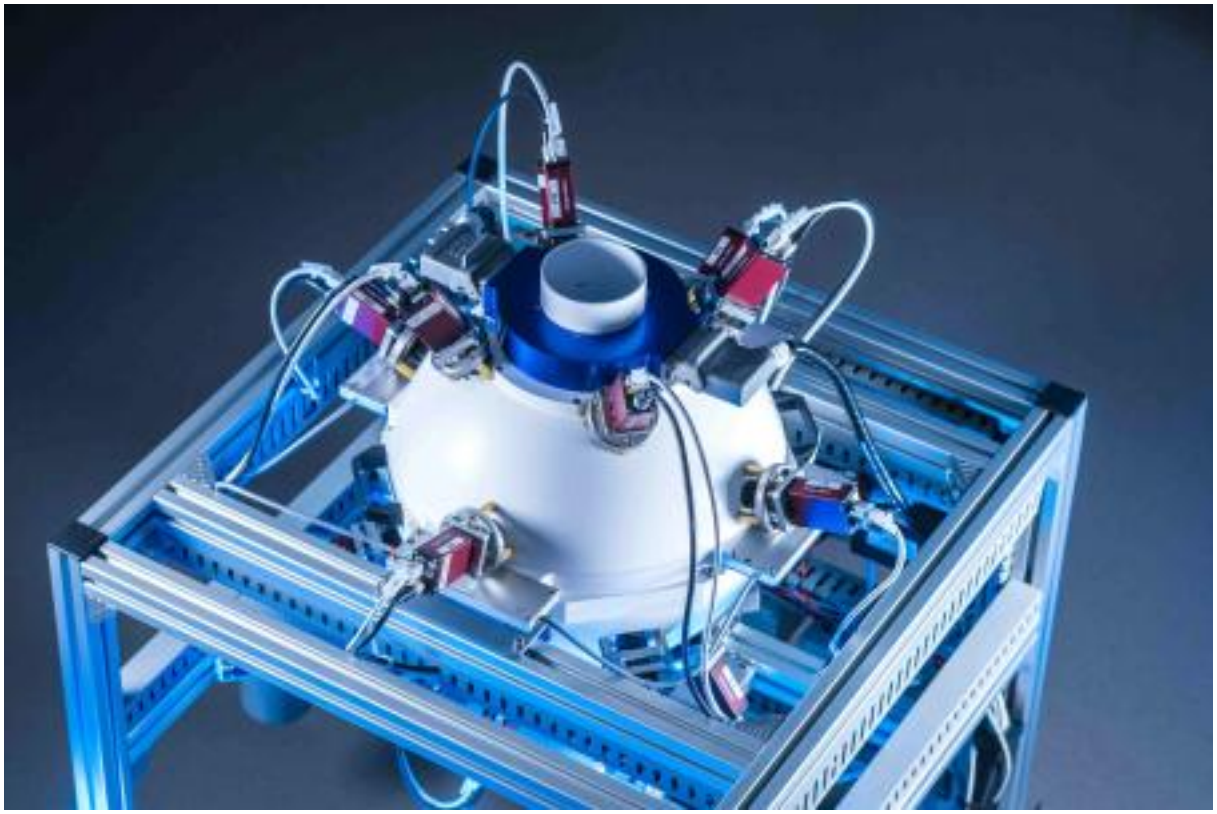
Making cold forming more resource-efficient: digital in-process testing

About this project



GUmProDig

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Markets:

Material: Aluminium, Magnesium, Steel, Titanium

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

Technology Transfer Program Leichtbau

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Context

A large proportion of CO2 emissions are caused by industrial production. Optimised production processes - for example in automotive or mechanical engineering - therefore offer great potential for reducing emissions.

Forming technology, in which raw parts are specifically brought into a different shape without removing material, offers great advantages over conventional production processes, such as machining, in which material is removed from the raw part. In addition to significantly lower CO2 emissions, formed parts also have very good mechanical properties, which makes them more resistant to loads and thus enables smaller designs. Until now, the production of formed parts with tight tolerances has required solutions specially tailored to the components or processes. In order to bring such forming processes into widespread industrial use without special solutions, generally applicable test methods are needed that guarantee the required quality even at very high production cycles. This is where the GUmProDig research project comes in.

Purpose

The researchers' aim is to use digitalisation to make cold forming more energy-efficient as a manufacturing process and to significantly improve the accuracy and surface quality of formed parts. This makes it possible to replace energy- and material-intensive machining in many areas. The project partners have calculated that the switch to this more resource-efficient manufacturing process and the reduction in rejects due to the shortened start-up phase of the forming process thanks to inline testing technology will already save large amounts of CO2.

However, the researchers expect the greatest contribution to CO2 reduction to come at a later stage: thanks to the continuous inspection and marking-free identification of the components, costly and resource-intensive recalls - which are particularly common in the automotive industry - can be prevented. According to the project partners' forecasts, this should enable total CO2 savings of more than 600,000 tonnes per year.

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Procedure

The project partners are developing an innovative free-fall inspection system for in-process testing of all manufactured components. The system enables them to precisely record many different quality parameters - such as geometry and surface quality. These parameters can be individually assigned to individual components together with other process monitoring data.

The components are transported individually, but without pre-orientation, via a conveyor belt into a measuring sphere and recorded in free fall from all directions using 16 cameras. Various image processing algorithms, some of which are AI-based, inspect the parts at up to three parts per second with an accuracy of a few micrometres. The project team also uses the individual surface structure of the parts at a defined point as a fingerprint, which can be used to trace them later.

Funding duration:

Project partner:

Funding sign: 03LB3008 **Funding amount:** EUR 1.7 million

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3008A - GUmProDig in the federal funding catalogue

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Project coordination

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Lightweighting classification

	Realisation
Offer	
Products Parts and components	✓
Services & consulting	

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Lightweighting classification

	Realisation
Field of technology	
Design & layout	
Functional integration Sensor technology	✓
Measuring and testing technology Component and part analysis, Visual analysis (e.g. microscopy, metallography), Non-destructive analysis	✓
Modelling and simulation Processes	✓
Plant construction & automation	
Recycling technologies	
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology	
Forming Impact extrusion	✓
Joining	
Material property alteration	
Primary forming	
Processing and separating Grinding	✓
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites	
Fibres	
Functional materials	
Metals Aluminium, Magnesium, Steel, Titanium	✓
Plastics	
Structural ceramics	
(Technical) textiles	