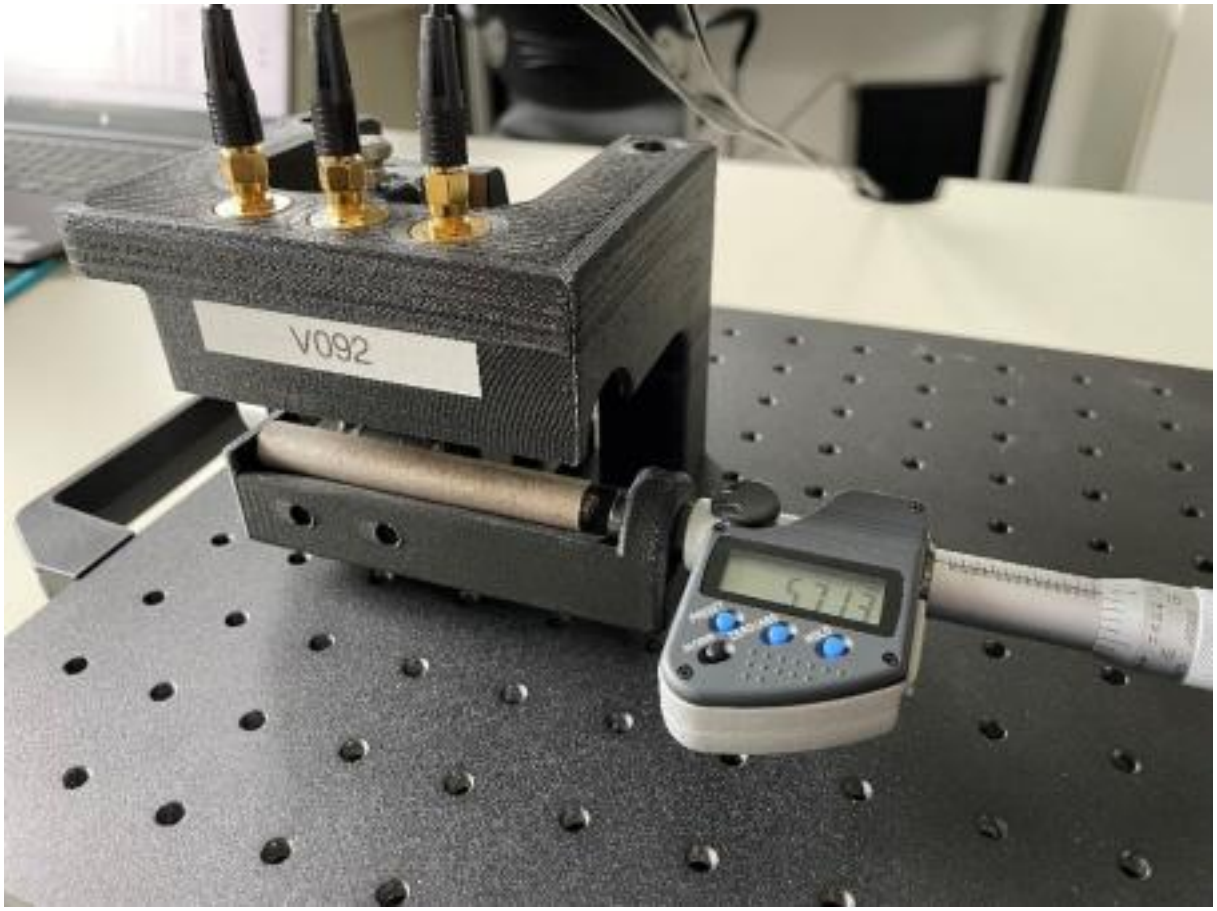
Improving quality assurance in 3D printing: acoustic testing method for metal components

About this project



SonicQuality

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Markets:

Material: Aluminium, Intermetallic alloys, Magnesium, Steel, Titanium, Others (High-performance alloys), Monolithic ceramics, Non-oxidic ceramics, Oxidic ceramics, Ultra-high-temperature ceramics, Ceramic matrix composite (CMC), Metal-ceramic composite, Metal matrix composite

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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

Metal 3D printing offers great potential for lightweight construction. Thanks to the great freedom of design, components can be bionically optimised and made significantly lighter than with conventional methods. This saves material, reduces energy consumption and enables more durable components. Despite these advantages, the industrial use of metal 3D printing is still limited. One key reason for this is the complex quality assurance process.

Previous testing methods such as computer tomography or dye penetrant testing are expensive, time-consuming and often not suitable for complex 3D-printed structures. The testing of high-performance materials that cannot be radiographed is particularly challenging. Without efficient quality assurance, the economic and sustainable use of additive manufacturing remains limited in many sectors, including aerospace, automotive and the energy industry.

Purpose

In the SonicQuality project, researchers are developing a new acoustic testing method to improve the quality assurance of metal 3D printed components. By using two non-destructive methods - process-compensated resonance testing (PCRT) and vibrothermography (SIR) - the aim is to reliably detect defects. The aim is to achieve cost savings of at least 90 per cent and an 85 per cent reduction in testing time compared to conventional methods. The new method will also require no consumables or harmful substances. In this way, the project team hopes to open up new application possibilities for metal 3D printing and achieve significant CO# savings. Standardisation measures should make the method widely applicable at the end of the project.

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Procedure

The project team combines two acoustic methods to enable comprehensive and automatable quality control. The PCRT technology analyses the resonance behaviour of components and compares it with a defect-free standard. This allows structural deviations to be identified. In addition, SIR technology recognises cracks and defects on the component surface through frictional heat. The combination of both methods enables fast, reliable and fully digital defect analysis, regardless of the material or surface condition. This represents a major advance over previous methods. The initial focus is on components manufactured using the widely used selective laser melting (SLM) process. However, the method should also be transferable to other additive manufacturing processes.

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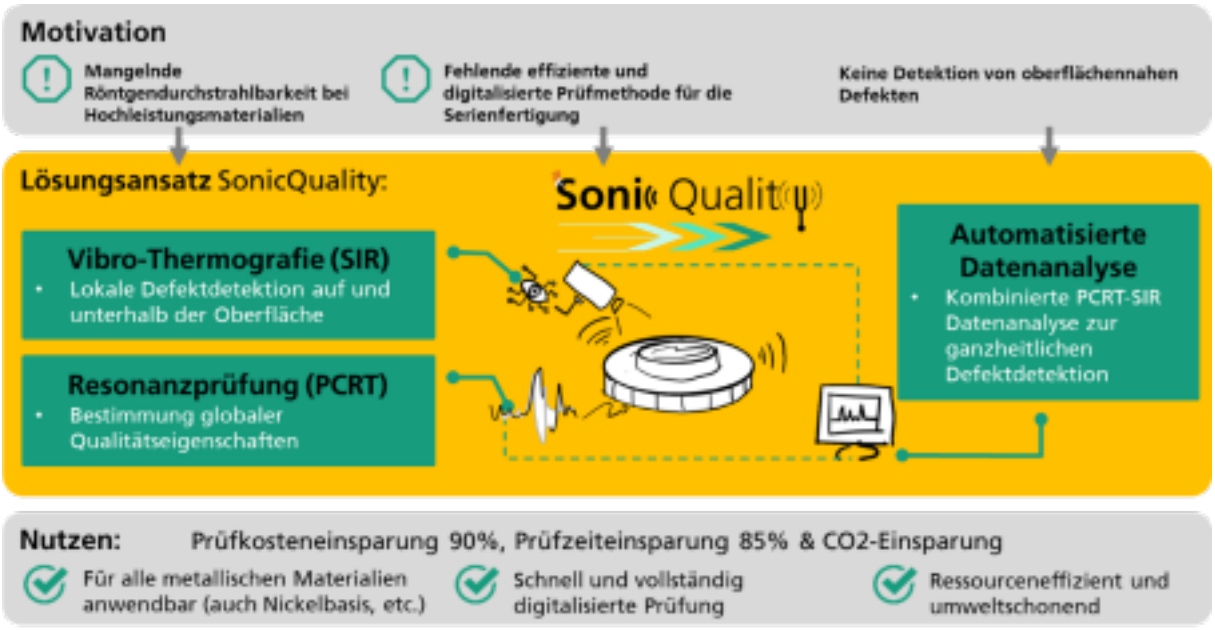

Funding duration:

Funding sign: 03LB5010 **Funding amount:** EUR 861 thousand

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB5010A - SonicQuality in the federal funding catalogue

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Project coordination

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FTT DEUTSCHLAND

Fraunhofer IAPT

Lightweighting classification

	Realisation
Offer	
Products Machines and plants, Software & databases	✓
Services & consulting Testing and trials, Validation	✓

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Lightweight manufacturing, Lightweight design	✓
Functional integration	
Measuring and testing technology Component and part analysis, Non-destructive analysis	✓
Modelling and simulation Structural mechanics, Materials	✓
Plant construction & automation Handling technology, Others (Testing technology)	✓
Recycling technologies	
Manufacturing process	
Additive manufacturing 3D printing, Selective laser melting (SLM, LPBF, ...)	✓
Coating (surface engineering)	
Fibre composite technology	
Forming	
Joining	
Material property alteration	
Primary forming	
Processing and separating	
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites Ceramic matrix composite (CMC), Metal-ceramic composite, Metal matrix composite	✓
Fibres	
Functional materials	
Metals Aluminium, Intermetallic alloys, Magnesium, Steel, Titanium, Others (High-performance alloys)	✓
Plastics	
Structural ceramics Monolithic ceramics, Non-oxidic ceramics, Oxidic ceramics, Ultra-high-temperature ceramics	✓
(Technical) textiles	