Finding optimal building materials: concrete construction with AI and 3D printing

About this project

AIBetOn3D

Finding optimal building materials: concrete construction with AI and 3D printing

Markets:

Material: Others (Concrete)

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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

The construction industry is one of the world's largest consumers of raw materials and energy and generates large amounts of waste. A large proportion of global greenhouse gas emissions are also generated during the construction, demolition and disposal of buildings. In particular, the production of concrete – one of the most frequently used building materials – with its main component cement causes considerable CO_2 emissions.

Purpose

The aim of the scientists in the AIBetOn3D project is to reduce the environmental impact of the construction sector. To this end, they are asking themselves the overarching question of how 3D printing can be used in concrete construction to minimise CO_2 emissions without compromising the quality of the construction products.

On the one hand, the researchers are developing simulation models for 3D printers with the support of artificial intelligence (AI), which should help to identify optimal building materials and combinations of building materials by enabling reliable predictions of material behaviour and potential CO_2 savings. The researchers are also working on an innovative 3D printer for building materials and the associated software.

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Procedure

As a concrete application, the researchers are looking at drainage channels and inlet boxes, which are to be implemented in different variants – in 3D concrete printing, combined 3D printing with concrete and plastic moulds and clay-based 3D printing. In addition to geometric parameters, material modifications are also being investigated.

They are developing a concept for a semantically causally correlated material production library. The AI-based algorithms and models developed are thus designed to understand the meaning of the data, analyse their relationships and recognise and use the causal relationships to enable precise predictions and optimisations. The library will contain information on novel, additively manufactured building materials and serve as a learning system to perform optimisation in terms of component dimensions, material composition and CO# life cycle analysis. In addition, the researchers are testing the practical suitability of the developed printer and the associated software based on the specific use case.

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Funding duration:			
Funding sign:	03LB2041	**Funding amount:**	EUR 1.1 million
Final report			
Further websites	foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2041A - AIBetOn3D in the federal funding catalogue		

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Project coordination

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English (EN){{ Projektpartner }}

Master Builders Solutions Deutschland GmbH

Lightweighting classification

	Realisation
Offer	
Products	
Services & consulting	

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Lightweighting classification

	Realisation
Field of technology	
Design & layout	
Functional integration	
Measuring and testing technology	
Modelling and simulation Materials, Others (AI-based process optimisation)	✓
Plant construction & automation	
Recycling technologies	
Manufacturing process	
Additive manufacturing 3D printing	✓
Coating (surface engineering)	
Fibre composite technology	
Forming	
Joining	
Material property alteration	
Primary forming	
Processing and separating	
Textile technology	

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Lightweighting classification

Material	Realisation
Biogenic materials	
Cellular materials (foam materials)	
Composites Others (Concrete)	✓
Fibres	
Functional materials	
Metals	
Plastics	
Structural ceramics	
(Technical) textiles	