Producing CO#-reduced concrete walls: 3D concrete printing robots

About this project

3DLight_OnSite

Producing CO#-reduced concrete walls: 3D concrete printing robots

Markets:

Material: Short fibre-reinforced concrete

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

Technology Transfer Program Leichtbau

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Context

Processes in the construction industry have been little digitalised and automated to date. Standardised and inflexible processes often lead to inefficient use of materials, energy, time and labour. Resource-intensive concrete construction in particular causes considerable CO# emissions. Additive manufacturing of concrete offers a solution that allows for specifically dimensioned cross-sections and significantly simplifies logistics on construction sites. Automation, digitalisation and new material approaches are considered together.

Purpose

In the 3DLight_OnSite project, researchers are developing an innovative concept for 3D concrete printing. The aim of the project partners is to use individually movable printing robots to produce structural-optimised concrete walls in CO#-reduced lightweight construction, thus combining sustainability, construction robotics and efficient production. In order to make optimum use of the economic and ecological potential of concrete printing, they are relying on end-to-end digitalised and highly automated production.

The results of the research project should make it possible for mobile robot fleets to move flexibly around the construction site in future and print the concrete elements directly on site. In contrast to stationary printing systems, which are less flexible and less scalable, this will enable faster, more cost-effective and more environmentally friendly additive manufacturing.

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Procedure

The prototype developed by the project participants includes a crawler chassis and an industrial robot with a special nozzle head for the 3D printing process. The researchers are digitising the entire planning and production process in order to optimise the use of the robots. All relevant construction data is modelled digitally and transferred directly to the robots. Digitalised production methods also offer advantages beyond the construction process. For example, building materials can be tracked and components can be sustainably dismantled and reused in the sense of "urban mining".

The researchers are also focussing on material savings through a lightweight construction method inspired by nature. For example, CO#-intensive, high-strength concretes are only to be used where they are structurally necessary. To this end, the project participants are using structures similar to honeycombs, which offer maximum stability with minimum material consumption. For example, the wall shell of a building is constructed from pressurised mortar and then filled with foam concrete, which serves as insulation and soundproofing. This construction method significantly reduces material consumption and CO# emissions. The project partners are also endeavouring to develop more environmentally friendly concrete mixtures.



Funding duration:

Funding sign:	03LB3059	**Funding amount:**	EUR 1.6 million

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3059A - 3DLight_OnSite in the federal funding catalogue

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Project coordination

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English (EN){{ Projektpartner }}

KADIA Produktion GmbH + Co.

Lightweighting classification

	Realisation
Offer	
Products Parts and components, Machines and plants, Software & databases	✓
Services & consulting Simulation	✓

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Lightweight construction concepts	✓
Functional integration	
Measuring and testing technology	
Modelling and simulation Optimisation	✓
Plant construction & automation Robotics	✓
Recycling technologies	
Manufacturing process	
Additive manufacturing 3D printing	✓
Coating (surface engineering)	
Fibre composite technology Casting (concrete)	✓
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 Short fibre-reinforced concrete	✓
Fibres	
Functional materials	
Metals	
Plastics	
Structural ceramics	
(Technical) textiles	