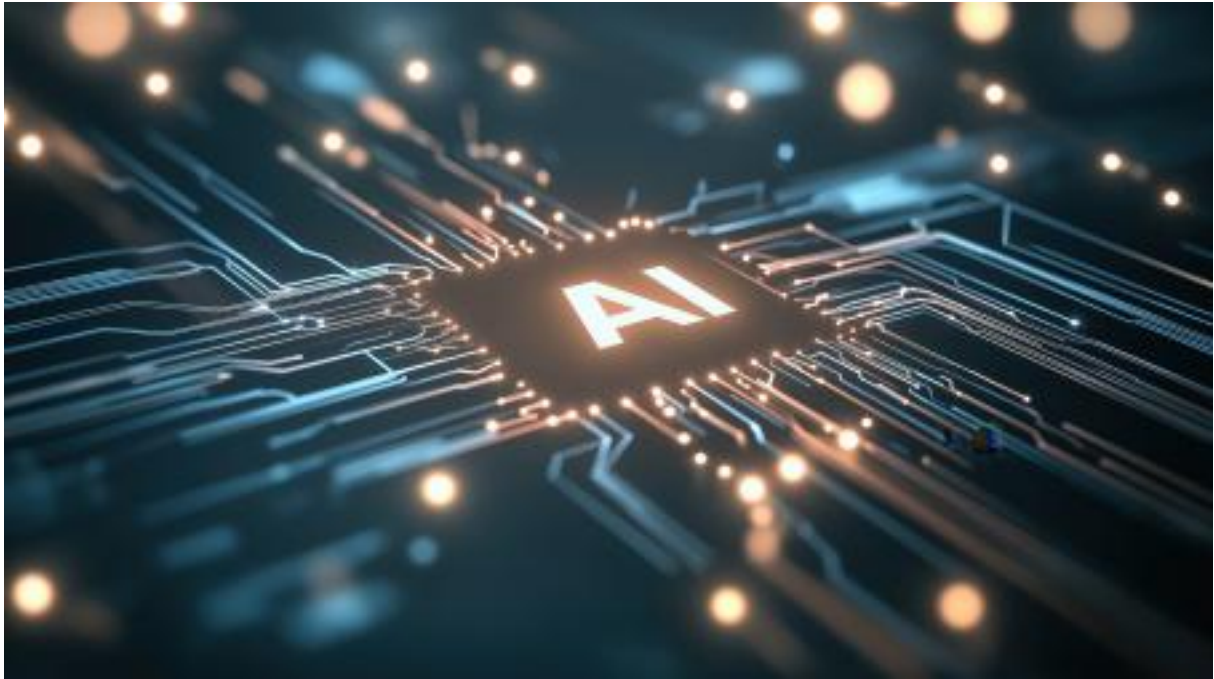


Development of lightweight components: AI system provides early and reliable evaluation

About this project



AITT

Development of lightweight components: AI system provides early and reliable evaluation

Markets:



Material:

Thermoplastics

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

Data-based product development has particular potential in lightweight construction. It combines design, analysis and production along the entire product development process. This allows companies to link data from computer-aided design (CAD), computer-aided engineering (CAE) and computer-aided manufacturing (CAM) with their own engineering knowledge about the products. With the help of artificial intelligence (AI) and machine learning methods, the effects of material and process selection on the carbon footprint, production and costs become visible as early as the planning stage.

The prerequisite for this is a reliable, expandable database that combines real engineering data from measurements and ongoing production with synthetic data - i.e. artificially generated, physically consistent data sets - and can be used across all industries. On this basis, companies can systematically evaluate and compare lightweight construction decisions and transfer them to new materials and processes. In this way, the approach supports sustainable, competitive product development and accelerates the transfer of knowledge across the board.

Purpose

The AITT project partners are developing a modular, AI-supported computer system for the development and production of lightweight components. In CAD, CAE and CAM, the system provides reliable assessments of CO₂ emissions over the entire life cycle, manufacturability and key cost drivers. Based on this, it suggests technically feasible alternatives to the materials or manufacturing processes used.

To this end, the team is building up a curated database of real and synthetic engineering data and training transferable machine learning methods on it. The starting point is additive manufacturing. The team then specifically incorporates injection moulding in order to test the models in different process environments and ensure technology transfer.

The researchers want to significantly shorten design and quotation times, reduce repetitions and save material and energy. Small and medium-sized companies in particular benefit from this: They prepare quotations faster, reduce risks and make documented engineering expertise more widely usable. This increases planning reliability and strengthens competitiveness - and at the same time measurably reduces emissions.

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Procedure

First, the project team records and pseudonymises the development, simulation and production data and harmonises it. At the same time, the system generates synthetic engineering data through simulations and targeted parameter variations according to the design of experiments principle and continuously compares it with measurement data. The team documents assumptions in short data profiles. Based on this, the project partners develop models for life cycle analyses, manufacturability and costs.

The team then trains machine learning methods with uncertainty estimation and checks the results. The researchers integrate the models as plug-ins into CAD, CAE and CAM programmes.

The application starts with pilot cases of additive manufacturing, such as orientation or support structures. The project team then transfers the findings to production processes in injection moulding, such as filling and cooling times.

With guidelines, training courses and open digital interfaces, the partners will ensure the transfer to widespread use. Key figures collected in the project document progress in terms of offer duration, repetitions and material and energy consumption.

Funding duration:

Funding sign:	03LB3058	Funding amount:	EUR 1.5 million
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Final report	oa.tib.eu/renate/items/f7616b58-addc-48ae-b9fb-1d7354398f51 - Joint final report
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Further websites	foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB3058A - AITT in the federal funding catalogue
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Project coordination

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English (EN){ { Projektpartner } }



Lightweighting classification

Realisation

Offer

Products

Software & databases, Tools and moulds



Services & consulting

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Lightweighting classification	
	Realisation
Field of technology	
<i>Design & layout</i>	
<i>Functional integration</i>	
<i>Measuring and testing technology</i>	
Modelling and simulation	✓
Processes	
<i>Plant construction & automation</i>	
<i>Recycling technologies</i>	
Manufacturing process	
Additive manufacturing	✓
3D printing	
<i>Coating (surface engineering)</i>	
<i>Fibre composite technology</i>	
<i>Forming</i>	
<i>Joining</i>	
<i>Material property alteration</i>	
Primary forming	✓
Injection moulding	
<i>Processing and separating</i>	
<i>Textile technology</i>	

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Lightweighting classification	
	Realisation
Material	
<i>Biogenic materials</i>	
<i>Cellular materials (foam materials)</i>	
<i>Composites</i>	
<i>Fibres</i>	
<i>Functional materials</i>	
<i>Metals</i>	
Plastics	✓
Thermoplastics	
<i>Structural ceramics</i>	
<i>(Technical) textiles</i>	