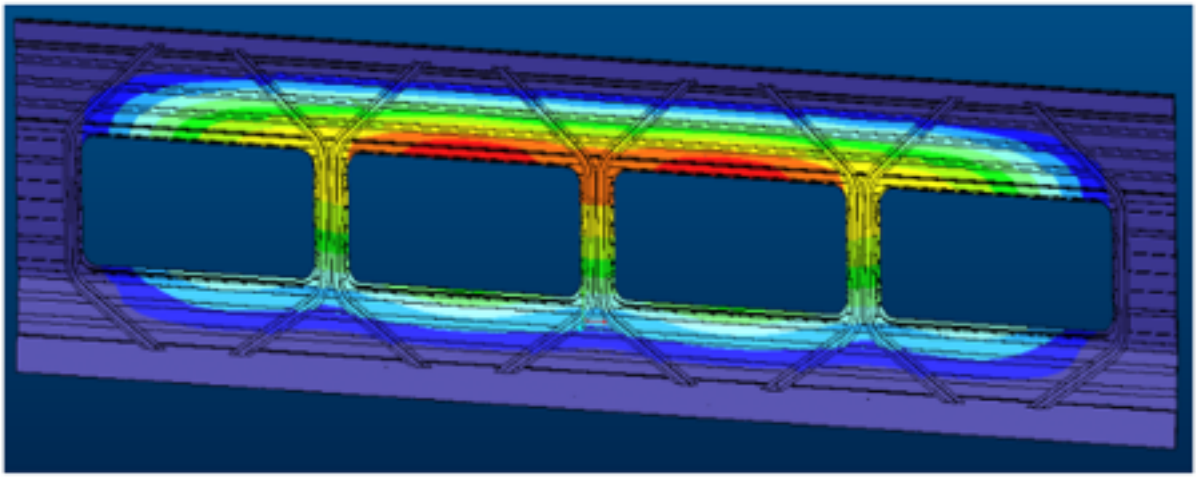
Making trains and ships lighter: Force flow-optimised, automated differential structures

About this project



LESSMAT

Making trains and ships lighter: Force flow-optimised, automated differential structures

Markets:

Material: Aluminium, Steel

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

Rail vehicles and cruise ships have the largest single mass in their bodyshell structures. Reducing this mass offers enormous potential for saving energy and CO2. A lightweight construction system that reduces this mass by 20 per cent can significantly reduce energy requirements. At the same time, both industries face the challenge that sustainable solutions must remain economically viable.

It is therefore necessary to implement lightweight construction measures not only in design, but also in production without incurring additional costs. Automated manufacturing processes play a key role in reducing costs and making production more efficient. This is where the LESSMAT research project comes in.

Purpose

At LESSMAT, the team is developing a cross-industry lightweight construction system that maximises local material utilisation while reducing production costs. The researchers are focussing on assemblies that are used in both industries, such as side walls, roofs and underbodies for rail vehicles or deck sections and walls for cruise ships. The designs are based on the differential construction method, in which sheet metal is combined with stiffening elements. The aim is to achieve maximum strength and rigidity with minimum use of material.

At the same time, the project team is developing automated production processes that take into account small batch sizes and a wide range of variants. A central task is the integration of digital tools in order to transfer design data directly to production. The project thus not only creates lighter and at the same time more resilient components, but also cost-efficient production.

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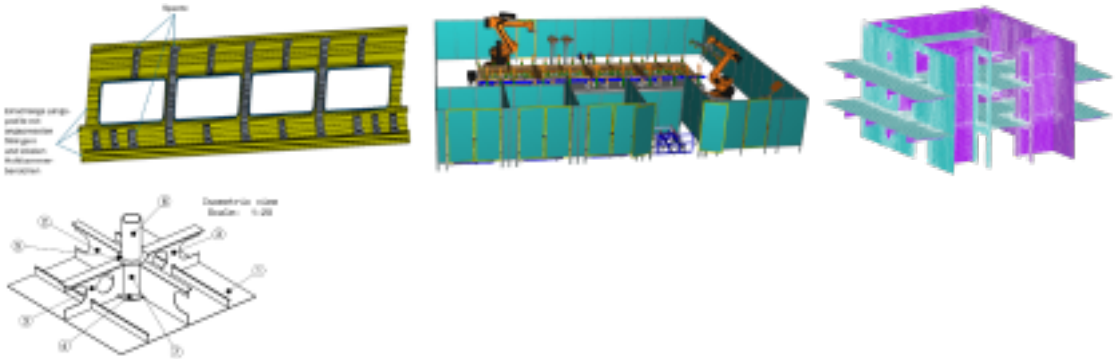
Procedure

The project team is working on three core areas. Firstly, the researchers are developing a design that enables greater local material utilisation. For example, bionic structures, optimised use of materials and partially differential assemblies allow them to significantly reduce the mass of the flat assemblies. Secondly, an automation solution is being created that takes over the production steps such as feeding, positioning, joining and testing. The aim is to adapt these processes to the requirements of small production batches, i.e. production batches with low quantities, while at the same time ensuring a high degree of flexibility for different variants.
Thirdly, the researchers are linking digital technologies with design. Simulation methods such as the finite element method (FEM) test the automation capability of the construction method as early as the design phase. The digital link also enables the seamless transfer of design data to production. The technologies developed are checked and optimised in real tests.



Funding duration:

Funding sign:	03LB2021	**Funding amount:**	EUR 2.9 million

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2021A - LESSMAT in the federal funding catalogue

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Project coordination

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English (EN){{ Projektpartner }}

Lightweighting classification

	Realisation
Offer	
Products Parts and components, Systems and end products	✓
Services & consulting Engineering, Simulation, Technology transfer	✓

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Lightweighting classification

	Realisation
Field of technology	
Design & layout Lightweight design	✓
Functional integration	
Measuring and testing technology	
Modelling and simulation Loads & stress, Life-cycle analysis, Optimisation, Structural mechanics, Others (Material flow simulation)	✓
Plant construction & automation Automation technology, Handling technology	✓
Recycling technologies	
Manufacturing process	
Additive manufacturing	
Coating (surface engineering)	
Fibre composite technology	
Forming	
Joining Welding, Others (Friction stir welding process)	✓
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	
Fibres	
Functional materials	
Metals Aluminium, Steel	✓
Plastics	
Structural ceramics	
(Technical) textiles	