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Project title:	DurableHybrid
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Mission Statement

The use of lightweight materials for weight reduction is primarily used in aviation, in the automotive industry and increasingly also for moving parts in general mechanical engineering. In particular, the material group of fibre-reinforced plastics (FRP) is characterised by a superior density-specific mechanical performance and the possibility of a load-adapted and function-integrated design.

A promising design principle in the course of multi-material construction is the hybridisation of the FRP material itself. In this process, several types of fibres are combined in one FRP component in order to use the specific advantages of the different types of fibres and at the same time compensate for the disadvantages. However, the design is very complex due to factors such as fibre dispersion or positioning. In addition, the design for each component must be application-specific in order to enable an ideal utilisation of the dynamic fibre properties. Although the improvement in properties has already been proven in research, there is a lack of commercial availability of standardised hybrid semi-finished products and design methods. As a result, non-hybrid FRPs are used for dynamically stressed components (e.g. spring elements). However, compared to hybrid FRP, these have a reduced fatigue strength and thus a shorter service life for the same component weight. As a result, non-hybrid FRPs have a significantly worse CO2 footprint.

The aim of the proposed DurableHybrid research project is therefore to improve the CO2 footprint of dynamically stressed FRP components by 30 % in a cost-efficient manner.

Approach:

The approach to achieving the goal is to increase the fatigue strength by hybridising the flat textile semi-finished products (so-called intraply hybridisation). The implementation is based on the example of bending-loaded spring elements (leaf springs) in mechanical and plant engineering, which can be found in similar form in almost all technical applications across all sectors. The commercial use of hybrid intraply semi-finished products to improve the dynamic property profile of FRP forms the central innovative character of the project.

Within the scope of the project, hybrid Intraply semi-finished products are first developed, characterized and simulation models derived with the help of comprehensive static and dynamic test series. The knowledge gained will then be used to design and manufacture prototypes of hybrid Intraply FRP spring elements and test them in an operational environment. The material- and model-specific data obtained in the process are then digitally processed and made available so that they can be used free of charge for the design of dynamically stressed FRP components. Users can thus select from standardised, hybrid semi-finished product variations and receive component-specific recommendations for increasing the dynamic properties (especially fatigue strength).

As a result of the increased degree of hybridisation and the associated extended service life of FRP components, CO2 emissions in Germany alone can be reduced by an estimated 1.1 million tonnes per year.

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