Univ.-Prof.
Prof. h.c. (Moscow State Univ.)
Dr.-Ing. Dipl.-Wirt. Ing.
Thomas Gries
Institutsleiter

Florian Brillowski
Scientific Researcher

Mein Zeichen: Bri
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Project title:	OptiDrape – Geometry-specific design of the draping process for FRP components
Partner:	Institut für Unternehmenskybernetik e.V. (IfU) an der RWTH Aachen University Fraunhofer-Institut für Techno- und Wirtschaftsmathematik (ITWM)
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Mission Statement

The draping quality of textile semi-finished products in three-dimensionally curved component geometries depends on the preforming parameters of material, process and geometry.

So far, there have been numerous studies on the influence of the parameters material and process. The component geometry parameter has not been systematically analyzed in the development process of new preforms. The evaluation of the component-specific drapability is usually based on estimates by experienced employees or time-consuming and costly trial & error test runs (Fig. 1). The lightweight construction strategy is often carried out by pure material substitution. This procedure is known as "Black Metal". With this procedure, the enormous potential of FRP materials with regard to shaping and lightweight construction is by far not fully exploited. This is economically inefficient with a high use of materials and money.

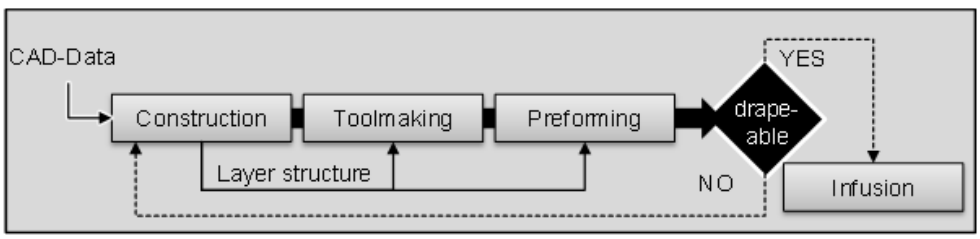

Fig. 1: State of the art draping process

Meanwhile, construction designs are seldom suitable for fiber composites. In the rare cases, the property of the component geometries (especially the suitability for preforming as well as the overall process) has not yet been taken into account. This is where the project comes in. The aim is to enable

the draping-compatible design of FRP components as well as the fiber composite-compatible design of components with regard to mechanical properties AND production. This includes the targeted exploitation of the anisotropy of reinforcing textiles, the development of draping-compatible component geometries and the systematic establishment of process parameters for the draping process. As a result, the aim of the "OptiDrape" project is to increase quality and shorten development times FRP preforms.

Approach:

In addition to the compilation of meaningful geometric key figures, draping-friendly alternative geometries are developed for selected geometric categories, which are characterized by a much better drapability with a slight geometric variation. In addition to the "Component geometry" parameter, the "Draping process" parameter is also listed in the Draping catalogue for selected component geometries. In order to optimize the determined results, machine learning technologies are implemented at the IfU and the OptiDrape software tool is developed. The influence of the process parameters, e.g. local textile prestressing and drapery kinematics, on the drape quality is investigated. The data required for this are generated at the ITWM using a FEM calculation method of the textile semi-finished products with a very high degree of detail at the roving level. This results in an efficient draping process suitable for the material (Fig. 2).

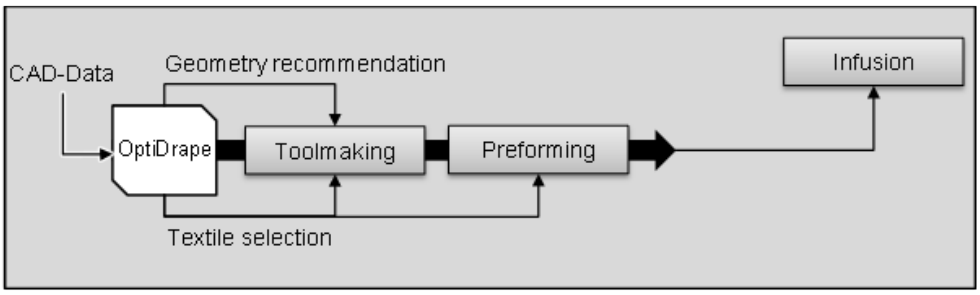

Fig. 2: OptiDrape approach

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Kontakt

Florian Brillowski, M.Sc.

Automated Composite Production

Tel.: +49 (0) 241 80 27662

E-Mail: florian.brillowski@ita.rwth-aachen.de

Marius Wiche, M.Sc.

Automated Composite Production

Tel.: +49 (0) 241 80 23445

E-Mail: marius.wiche@ita.rwth-aachen.de