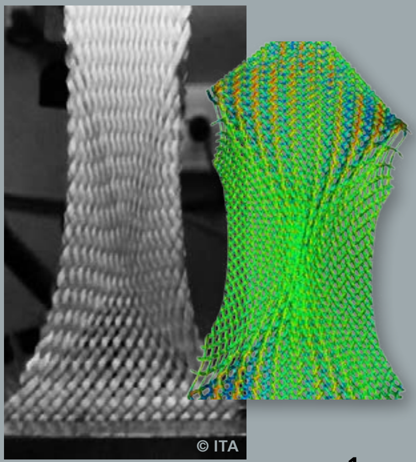


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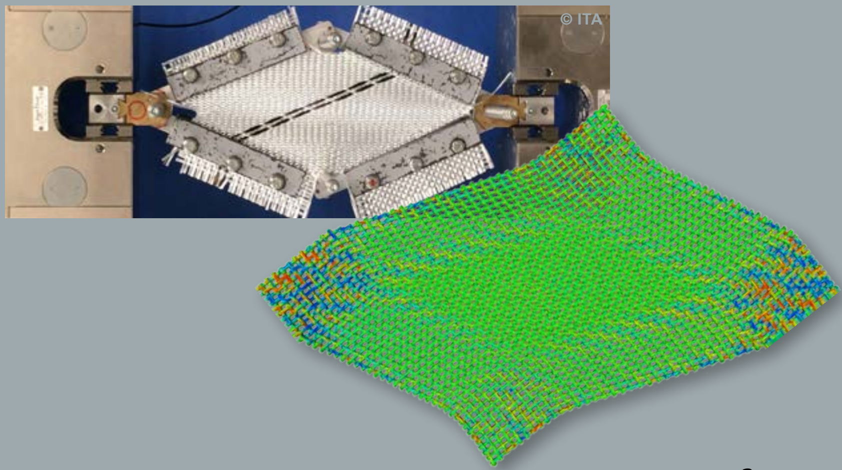


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# OPTIMIZING THE DRAPING PROCESS FOR FRP COMPONENTS MADE FROM HIGH PERFORMANCE TEXTILES

1 *Critical shear angle experiment performed by ITA and simulation of wrinkling*

2 *45°-tension test of a woven fabric with fixed frame performed by ITA and corresponding simulation*

As part of the AIF Project OptiDrape we are developing a draping catalog for small and medium-sized enterprises (SMEs) in cooperation with the Institute for Textile Technology (ITA) and the Institute for Management Cybernetics (IfU), Aachen.

The potential of components made from fiber reinforced polymers (FRP) is highly dependent on the type of reinforcing textiles used and their drapability (ductility). The draping quality is evaluated on the basis of defects and wrinkles in the textile after preforming. Preforming refers to the process for producing a dry reinforcement structure. The potential of the anisotropic material is enormous for lightweight construction and can be specifically exploited only if the textile fibers are present locally in the required orientation. The draping process takes place during the production of complex geometries by experienced specialists. From a technical and economic point of view, the process lacks standards and objective criteria and requires optimization.

**Improve quality and shorten times**

The aim of the OptiDrape project is to improve the quality of the preforms for FRP components and to shorten the development time. We classify the different mats and weaves in terms of draping properties according to the type of bond as well as by the roving material and cross-sections. A roving is a bundle, strand, or multi-filament yarn made from parallel filaments. Also, a textile-specific shear angle is given. This indicates the point at which the textile starts to wrinkle. We selected a total of 16 carbon and glass fiber textiles with different cross sections and bond types as well as various offsets. ITA conducted a number of experiments and determined the effective tensile, shearing, and bending properties and shear angles. In parallel, we also used our FEM software to simulate and validate these properties. In contrast to experimentation, simulation at the roving level enables a virtual material design with precision detail. Among other things, the roving cross sections as well as the materials and distances of the bonds can be more efficiently varied; and, the experiment catalog was significantly expanded.

**Model for a wide range of uses**

The project used comprehensive mathematical analysis to develop a predictive model that calculates the critical shear angle. It relies on previously defined roving materials and dimensions, the type of bond, as well as experimentally determined contact point data. Additional model parameters include the offset of the bond as well as the distances. The resulting model not only allows companies to set up a very broad catalog, but also to continuously vary all of the design parameters for any application and requirement in the interests of optimizing the design.