

Task 1.1.1: Processability of the angle directed fixation of large textile preforms

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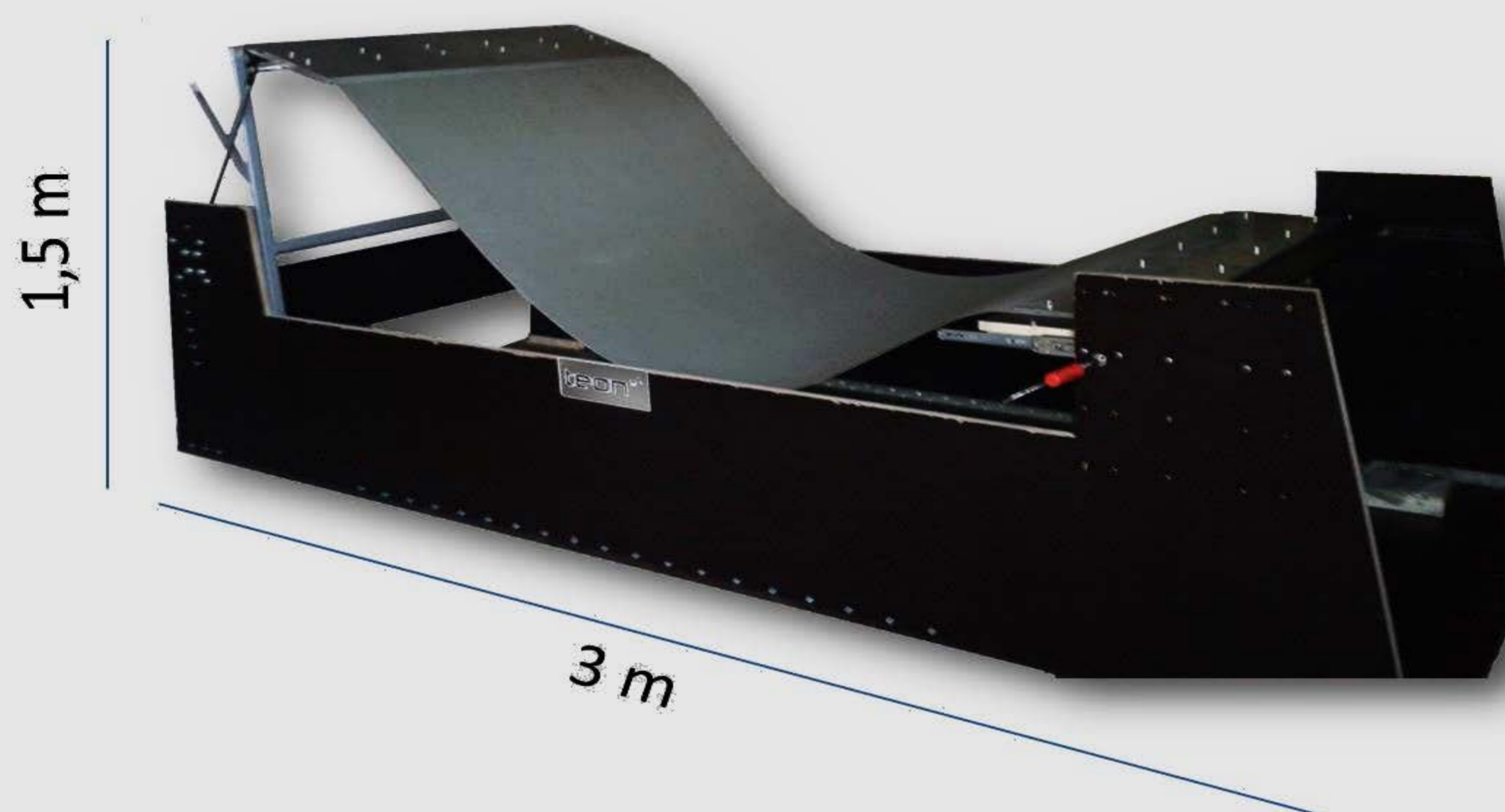


Figure 1: Form variable preform tool (section of a rotor blade in a scale of 1:2)

Motivation

As a part of the Smart Blades project a bending-torsion coupled rotor blade with asymmetrical lay-up will be designed. From the manufacturing point of view the challenge is to position the fibers in the exact fiber angle. The chosen manufacturing concept provides a precise angle fixation of the fiber layers with binder materials. In addition to that the transport of the preforms to the main mold must be examined. As third topic the fibers should be placed flat and preformed as whole stacking. Therefore the mold needs to be formable like shown in Figure 2. Figure 3 shows a concept of a variable tooling concept.

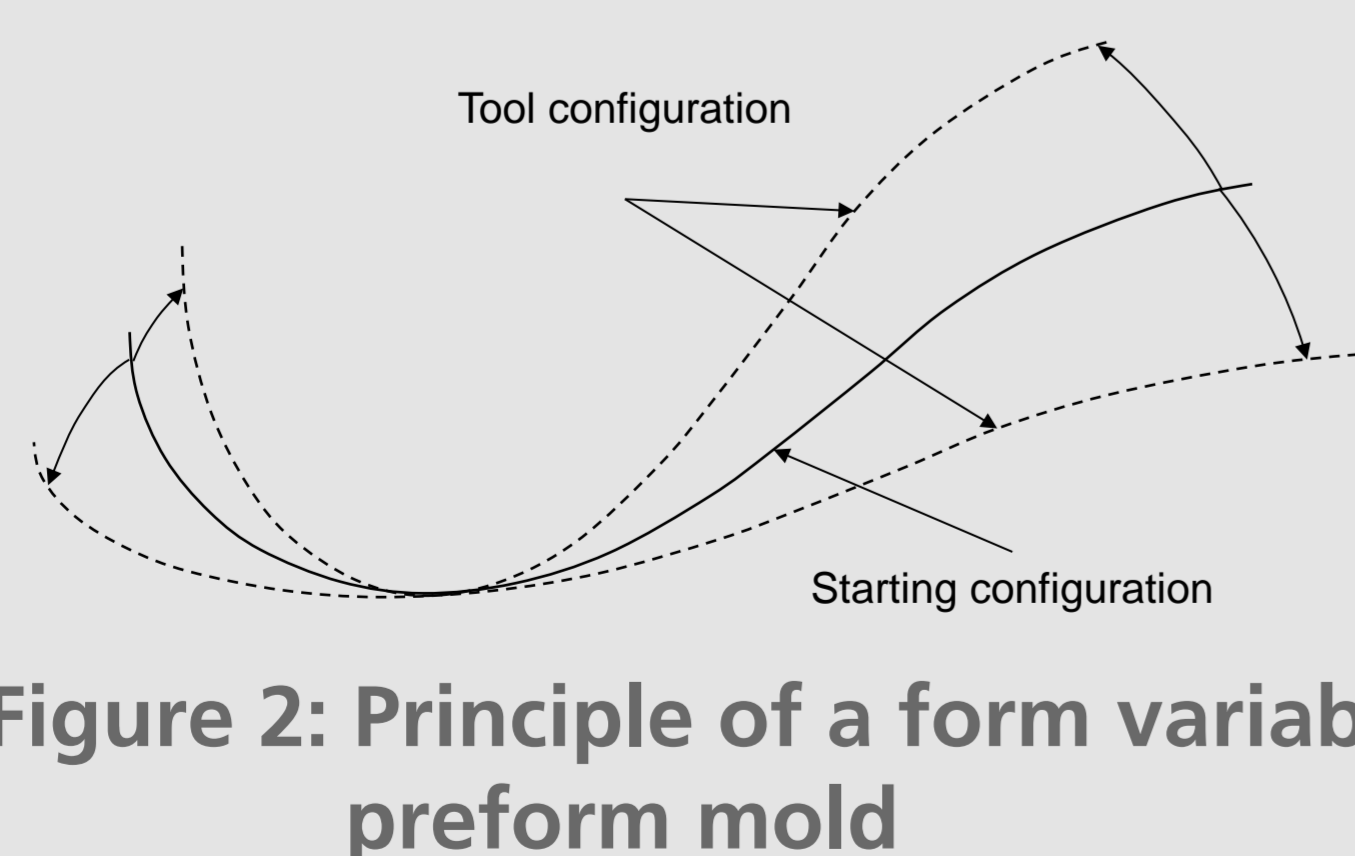


Figure 2: Principle of a form variable preform mold

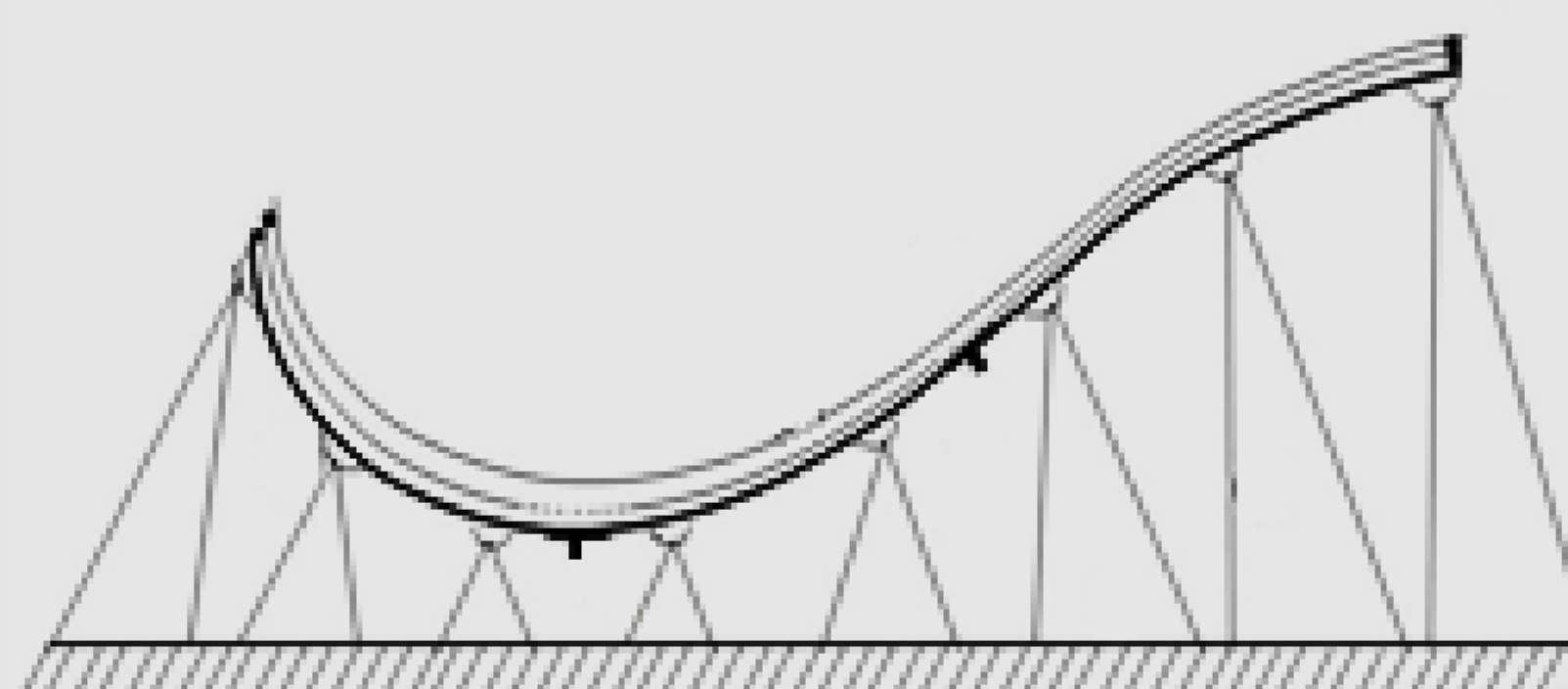


Figure 3: Form variable tooling concept with actuators

Functioning of the tooling

Molds for rotor blades are usually made of glass fiber reinforced plastics. They have the advantage to be similar in thermal expansion as the rotor blade components. The high flexibility provided by the glass fibers is required to realize a morphing structure with this dimensions.

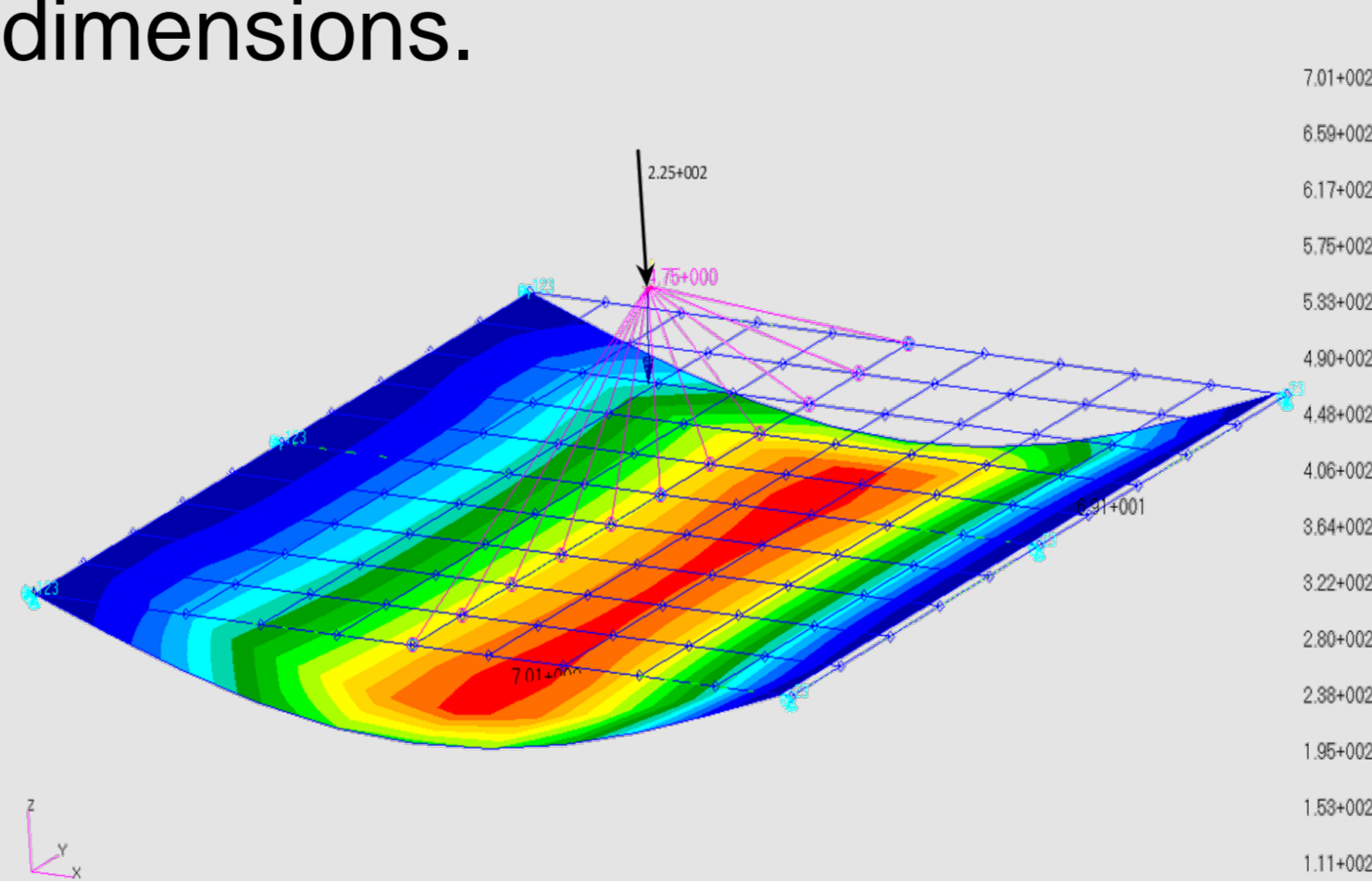


Figure 4: Optimization of layer thickness

After an optimization of the design parameters (fig. 4), the preform tool shown in figure 1 has been build.

The tool consists of one fiberglass panel for the tooling surface that gets it's geometry by two movable carriages at each end. With this structure the representation of the different profile geometries is possible (Fig. 1).

By tilting of the front carriage the membrane can be moved up and down. The rear carriage can be moved horizontally. Thereby plane as well as double-curved geometries can be constituted. By discrete application of binder the layers are prefixed. The positions of the binder application depend on final contour and chosen fiber material. Due to the fixation only the non-bindered areas slide off from each other.



Figure 5: KUKA- Robot + OMNIMOVE Platform

Transportation of Preforms

For removing the preform it has to be stabilized. Based on technology analysis a transportation system for a vacuum compacted stacking will be established. The stabilized preform will be transported by robot platforms (figure 5).