

Active-Bending Structure from Natural Fibre Profiles

In August 2021, the BioMat Pavilion 2021 was inaugurated on the campus of the University of Stuttgart in a ceremonial setting and in compliance with the hygiene concept. The core of the elegantly curved lightweight construction is an active-bending structure made of natural fibers, reminiscent of bamboo. It was developed as part of the "LeichtPRO" research project.

The LightPRO Shell Pavilion is a lightweight structure that combines an active-bending gridshell made of natural fibre biocomposite profiles with a tensile membrane. The resulting system is a combination of two doubly curved surfaces that share a continuous beam outline. The outline is composed of two connected profiles that act as a beam, transferring forces from both systems to three anchor points attached to a superficial foundation.

The developed 'bamboo-like' natural fibre-based biocomposite profiles are newly produced through the pultrusion technique. Pultrusion is a continuous process for manufacturing fibre reinforced polymers with a constant cross section. In this project, natural flax and hemp fibres were used. The produced profiles are hollow, with a diameter of 25mm and 4mm thickness and lengths ranging from 6.5m to 12.5m to fit the required span. The pavilion has a covering span of 10m and maximum height of 4.8m at the perimeter.

Traditional diagonal lashing methods with steel cables are used to join the profiles in a grid. The grid is connected to the beam outline via a customized joint system. The membrane is attached to the three foundations and tensioned along the perimeter using rope lacing. This innovative structure is demonstrating a sustainability approach towards future architecture. The outcome is based on several years of research in the field of biobased materials application.

About the "LeichtPRO" project

The LeichtPRO research project was launched in 2019 by the Agency for Renewable Resources (FNR), a project managing organization which is funded by the German Federal Ministry of Food and Agriculture (BMEL). (FKZ: 22027018). The material development and production were carried out by the German Institutes for Textile and Fiber Research Denkendorf (DITF) as well as the companies CG-Tec and Biocomposites And More. The company Zenvision provided support in the design, technical product development and market development phases, the tool manufacturers Steinhuder Werkzeugbau helped to evaluate an additional connecting system for the structure, and the membrane was produced and sponsored by the Swiss planning specialists Bieri.

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Further information

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