Structural Timber Fabric: Applying Textile Principles on Building Scale

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Textiles are interesting from both an architectural and an engineering point of view. Their patterns and textures, created by the interworking of yarn elements, are not only highly appealing on an aesthetical level, they also possess load bearing qualities. In the context of investigating textile principles on building scale, the structural performance of the Textile Module in timber form was examined. Resulting from this study, the dimensions and proportions of the joint panels were determined. In a following step, the structural performance of the Textile Module was simulated with the FEM software Abaqus. The research project Structural Timber Fabric: Applying Textile Principles on Building Scale was launched and is aimed at developing innovative timber-based applications for the structural timber industry.

Principles on Building Scale

In a following step, the structural performance of the Textile Module was examined. Resulting from this study, the dimensions and proportions of the joint panels were determined. In a following step, the structural performance of the Textile Module was simulated with the FEM software Abaqus.

A second possibility is to create a fabric that is continuous in the overall structural capacities by large amounts of elements perpendicular to the arches which also improve the cross direction. A possible reaction to that is the addition of linear anti-tide elements that are independent from each other. There’s no continuity in the module narrows, becomes higher and therefore stiffens but in the same time, the sectional triangle in the middle of the module remains, becomes higher and therefore stiffens. It is a spatial structure.

Simulated assembly and form generating process with FEM software Abaqus.

The most obvious method of doing so is to combine several elements, or, in other words, as unit cell of such a structure. This insight triggered an adjustment in the direction of investigation. Instead of aiming at a comprehensive overview of existing techniques, the quest for a least common denominator of textiles was launched. This quest resulted in the so-called denominator of textiles was launched. This quest resulted in the so-called ideal textile module and consists of two intercrossing threads. From a spatial and structural point of view, these threads are ideal as well as the ideal system effect: they are made up of many basic elements. A spatial structure.

During the process of evaluating textile techniques regarding their suitability for large scale applications, a tremendous cross- and, consequently, from the remaining linear module such as knitting, braiding and weaving, an immense amount of varieties are noted. This insight triggers an exploration of the effects of this approach. In the context of the research project “Unnatural Architecture”, the quest for a least common denominator of textiles was launched. This quest resulted in the so-called ideal textile module and consists of two intercrossing threads. From a spatial and structural point of view, these threads are ideal as well as the ideal system effect: they are made up of many basic elements.

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For the continuation of this research, the work with FEM software will be further important. A geometry generating approach to draw near a geometrical description of the Textile Module was examined. Resulting from this study, the dimensions and proportions of the joint panels were determined. In a following step, the structural performance of the Textile Module was simulated with the FEM software Abaqus.

A large scale construction of the Textile Module was developed in the context of the exhibition “New Thinking”, which ran on the Swiss Federal Institute of Technology in Zurich from 21st to 26th of May 2010. It was placed in front of the ETH library as a memorial to the late architect and designer Felix Haid. It was intended to convey the message that textiles are not only highly appealing on an aesthetical level, they also possess load bearing qualities.

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