Series: Realistic Simulation of Technical Textiles

Generating Structures with MeshUp

The simulation software TexMath of the Fraunhofer Institute for Industrial Mathematics ITWM is used to simulate mechanical material properties. The goal: to accelerate the development by fewer experiments and optimize the design of technical textiles at the same time. The software consists of individual components with different functions and areas of application, which will be presented one after the other for Textile Network in a short series. The structure generator »MeshUp« makes the start.

MeshUP is used for the structure generation of weaving patterns and looping diagrams that transform them to structural meshes, on which mechanical properties can be computed. »We can create periodic textile structures of different types according to the respective machine control with complex knits and weaves«, Julia Orlik, a scientist at Fraunhofer ITWM, explains the functionality of the component. »This includes woven and knitted textiles, and spacer fabrics «.

Consideration of looping diagrams, weave types, thread dependency, and contact points

These textiles are produced using knitting or weaving machines. Thus, a binding cartridge is available for each textile, which is read into the machine or predefined. This can be generated and graphically mapped by MeshUp. Different looping diagrams, the yarn path and all contact points between the different yarns are taken into account. For further simulations by TexMath, MeshUp can translate the looping diagram of knitting or weave cartridges into appropriate input formats and also has interfaces to some commercial software packages, as e.g., Abaqus.
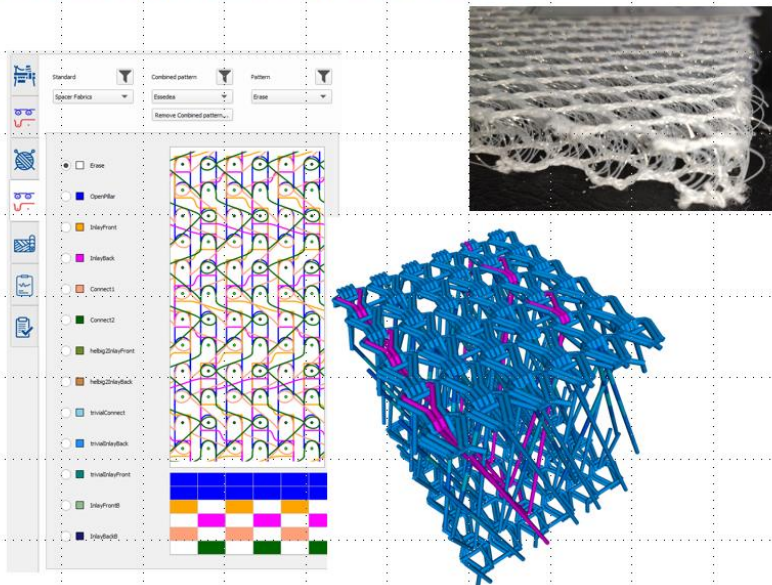
In addition, the tool provides the geometry as volume data, in voxel format, which makes easy to perform further fluid simulation through

the structure and computes its permeability, heat conduction etc. with the help of computational tool GeoDict.

There's more

MeshUp is one of three components of the TexMath software, each of which perform different tasks. The simulation generated in MeshUp can be used for further processing in the »FIFST« and »FibreFEM« components. The simulation software from the »Technical Textiles« team of the »Flow and Materials Simulation« department of Fraunhofer ITWM enables accelerated development as well as optimized design of technical textiles. By using the software, fewer experiments are required in the manufacturing process, minimizing costs and time.