

TexMath GeoApp

The TexMath GeoApp is a structure generator for representative volume elements of weft-knitted and warp-knitted textiles. Generated structures are periodic in in-plane direction and can therefore be directly employed, e.g., in subsequent fluid-flow simulations or thermal conductivity simulations. Output of the GeoApp is the textile structure in analytical format (.gdr).

The screenshot shows the 'GeoApp - GeoDict_TexMathApp' window. It features a 'GEO DICT' logo at the top left. The main interface is divided into several sections:

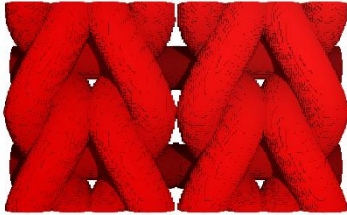
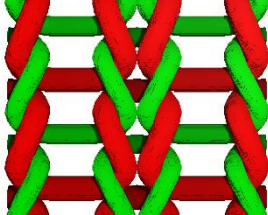
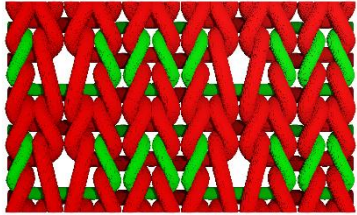
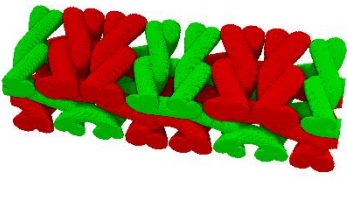
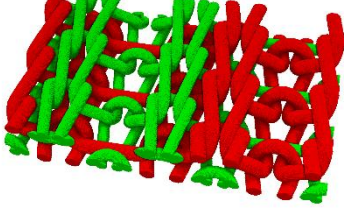
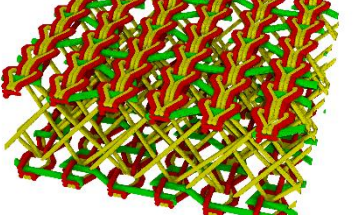
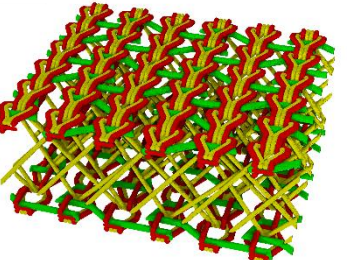
- Result File Name / (*.gdr):** A text input field containing 'TexMathResult'.
- Structure Input:**
 - Structure Type:** A dropdown menu set to 'Weft_Knit'.
 - Weft-Knit Type:** A dropdown menu set to 'WeftKnit_Interlock'.
 - Yarn 1 diameter / (mm):** A text input field with '0.15'.
 - Yarn 2 diameter / (mm):** A text input field with '0.12'.
 - Needles per distance / (1/mm):** A text input field with '1.8'.
 - Rows per distance / (1/mm):** A text input field with '3'.
 - Layer distance / (mm):** A text input field with '0.3'.
- Generator Input:**
 - Number of pattern repeats in column direction:** A text input field with '2'.
 - Number of pattern repeats in row direction:** A text input field with '2'.
 - Voxel size / (mm):** A text input field with '0.01'.

At the bottom, there is a toolbar with icons for file operations and a 'Cancel' button.

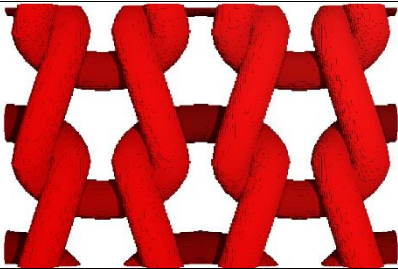
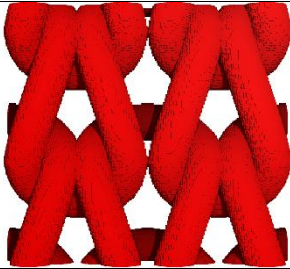
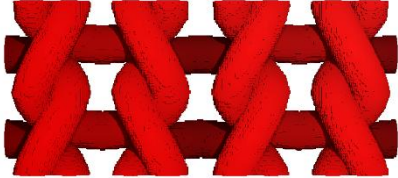
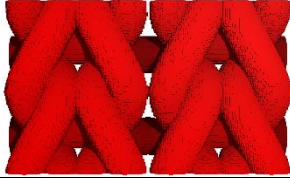
Structure Input

The TexMath GeoApp offers the choice between generating weft-knitted textiles and warp-knitted spacer fabrics. The respective type can be chosen from the **Structure Type** combobox. For both weft and warp knit, a pre-defined pattern option can be chosen from the **Weft-Knit Type** and **Warp-Knit Type** comboboxes, respectively.

Depending on the chosen pattern type, additional geometric inputs are required. Each textile pattern contains up to three distinct yarn types. Each yarn type has an input for its **yarn diameter**. An overview of the available textile patterns and the respective yarn types is provided in the figures below.

		
Weft Knit – Pure Knit	Weft Knit – Miss Example 1	Weft Knit – Miss Example 2
		
Weft Knit – Interlock	Weft Knit – Rib	Warp Knit – Spacer Fabric Atlas A
		
Warp Knit – Spacer Fabric Atlas B		

The counts of **needles per distance** and **rows per distance** determine width and height of loops within the textile pattern, respectively. Providing larger values results in a denser textile structure, while smaller values result in larger distances between yarns. To prevent yarn overlap, both values have a maximal possible value dependent on the yarn diameters. In case a pattern with three-dimensional structure is chosen, a **layer distance** between individual textile layers in thickness direction can be provided in addition. The figure below illustrates the effect of changing the needle and row count per distance.

	
Small needle count, small row count	Large needle count, small row count
	
Small needle count, large row count	Large needle count, large row count

Generator Input

The generator input options are the same for all available textile patterns. As the latter are periodic in the in-plane directions, the underlying structure can be repeated periodically in both column and row directions to generate a larger textile. The respective **number of periodic pattern repeats** can be provided. A value of 1 in both fields results in generating the smallest possible periodic unit of the textile.

The **voxel size** determines the spatial resolution of the generated structure. It is generally advised to choose the voxel size as a fraction of the smallest yarn diameter to properly represent the geometry in subsequent simulations.

Result Viewer

After successful generation of the textile structure, it is loaded automatically in the **3D Viewer** in analytical form, and a summary is displayed in the **result viewer**. In case an error occurs during structure generation, e.g. because chosen geometric input parameters are incompatible with each other, a respective error message is displayed.

In the result viewer, the runtime for generation is displayed when choosing **Results→Report**. By choosing **Results→Map**, the size of the generated geometry is displayed, as well as the solid volume percentage of the present yarn types and the entire structure. An overview of chosen input parameters is displayed when choosing **InputMap**.