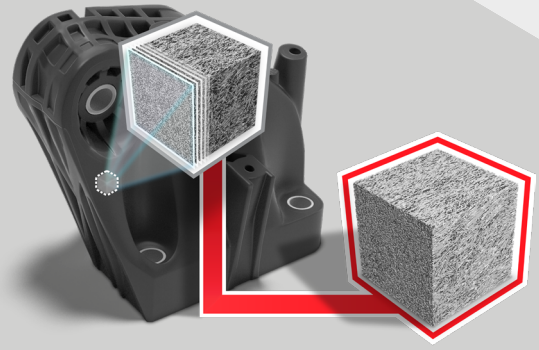
GeoDict

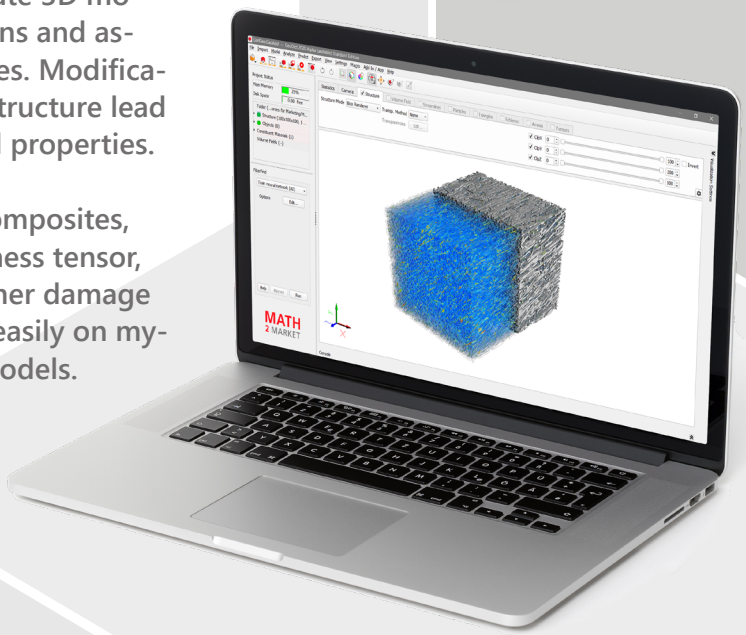
The Digital Material Laboratory

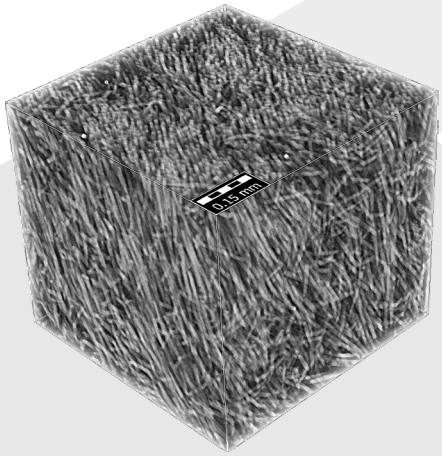
GeoDict Workflow for Composites

Import a µCT-Scan of Composite and Simulate its Mechanical Behavior

- The microstructure of a composite is revealed in detail from an imported and segmented µCT-scan. Usable statistical data is obtained by analysis, e.g. fiber identification and determination of fiber orientation and diameter.
- The statistical information obtained from the µCT-scan is used to generate 3D models on which to run simulations and assess their mechanical properties. Modifications of the 3D models microstructure lead to changes in their mechanical properties.
- The mechanical behavior of composites, including the anisotropic stiffness tensor, nonlinear deformations, polymer damage and fiber failure, is simulated easily on myriads of variations of the 3D models.







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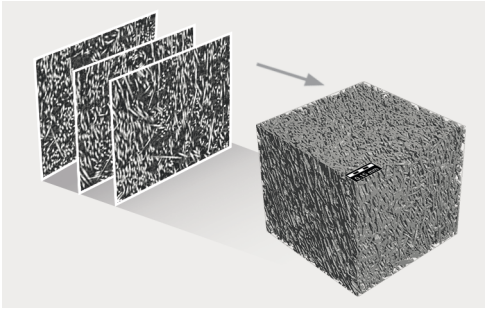
GeoDict® Workflow for Composites

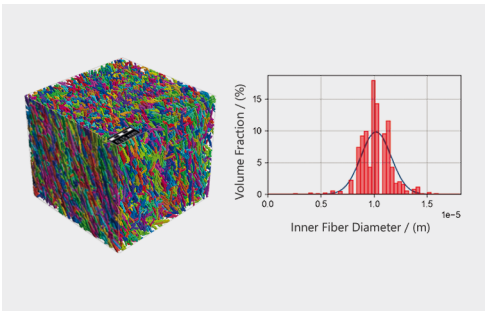
1 Import



- Take a µCT-scan of the composite and import it into GeoDict
- Apply image filters to enhance contrast, remove artifacts or reduce noise
- Segment imported scan by using manual or OTSU threshold

Result: Digital 3D model of the composite

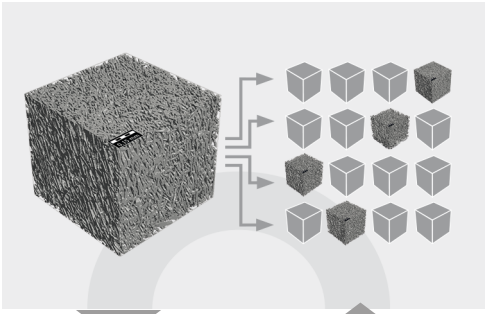
2 Analysis



- Each individual fiber is identified through Artificial Intelligence
- Analyze fiber length distributions, fiber orientations, fiber curvature, and fiber diameter
- Identify and analyze voids and inclusions
- Extract this statistical data to create a statistical 3D model of the composite with just a few clicks

Result: Statistical 3D model of the composite

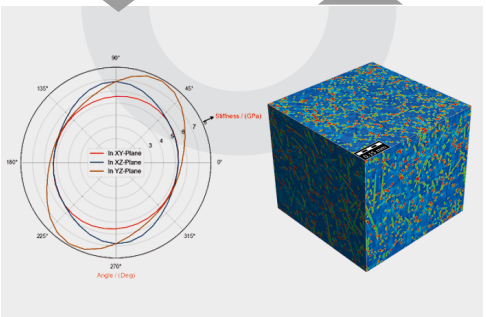
3 Modeling & Design



- Generate many digital prototypes with modified fiber parameters using GeoDict's fiber generator module
- Vary individual parameters, such as the fiber volume content.
- Automate the generation of digital prototypes and the variation of parameters through scripts for enhanced productivity

Result: Digital 3D models of modified composites

4 Property Prediction



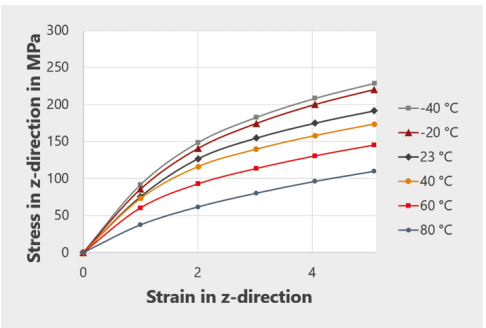
Predict mechanical properties of 3D models of composites by:

- Determining the anisotropic stiffness tensor
- Investigating influence on mechanical properties of reinforcement, polymer type, imperfections (e. g. voids), etc.

Example: Run parameter study for the influence of fiber content on stiffness

Result: Mechanical properties of the composite prototypes

5 Simulation



Simulate linear and nonlinear deformation of the composite to obtain information about:

- Elastic and plastic strains and stresses
- Damage in the polymer
- Failure of fibers
- Influence of polymer properties and fiber properties

Example: Influence of operating temperature on plastic deformation

Result: Mechanical behavior of the composite

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