Seminarreihe im Rahmen des GRK 2078

Referee:	**Emeritus Professor Stepan Lomov** Faculty of Engineering Science, KU LEUVEN University, Netherlands
Dates:	Tuesday, May 24, 2022
Time:	14:00h
Format:	IRTG Online Seminar Series
Title:	**Meso-finite element modelling of textile composites: Is there a "silver bullet" to kill yarns interpenetrations and create a reliable mesh?**

Abstract

Geometrically, a textile reinforcement is a very complex object. During weaving, yarns are interlaced, stretched and compacted. Being compliant transversely, yarns are diversely shaped due to interactions with a mould and with each other. An ideal meso scale model must capture the main geometric features of the textile architecture without running into excessive nuances of its highly uncertain geometry. The available geometrical models (WiseTex, TexGen) do not prevent yarns interpenetrations in all cases. Most mesh generation techniques, used for meso-level (unit cell scale) modelling of textile composites produce conforming discretisations to capture accurately the local fields at the yarns surfaces. Such discretization techniques in woven composite RVEs are however often impeded when residual interpenetrations between yarns are present in the geometry description. The handling of the interpenetrations may lead to modification of the internal geometry, which has to preserve descriptors of the fibrous geometry, which are paramount for the mechanical performance of the composite. The most important of these descriptors is local fibre fraction and the overall fibre volume fraction in the unit cell.

The presentation in the colloquium, after a brief introduction of the meso-finite element modelling of textile composites, gives a critical overview of available solutions for the construction of a finite element mesh for a textile composite unit cell, which preserves the important features of local and global fibrous architecture of the unit cell. The following methods are considered:

A. Based on unit cell geometrical pre-processors (WiseTex, TexGen) and other geometry descriptions:
    1. “Consistent unit cell geometry” – modification of yarn volumes
    2. Digital chains
    3. Superimposed meshes (embedded regions)

B. Based both on “ideal” geometrical models of µCT images
    4. Voxel meshes
    5. Level sets

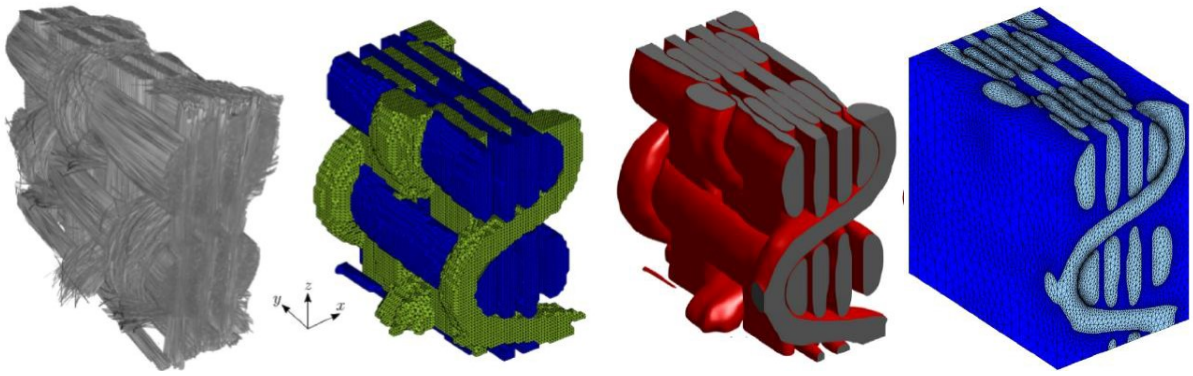

Figure: µCT image – voxelisation – non-penetrating volumes (level set method) – FE mesh

[Wintiba, B., D. Vasiukov, S. Panier, S. V. Lomov, K. E. M. Kamel and T. J. Massart (2020). "Automated reconstruction and conformal discretization of 3D woven composite CT scans with local fiber volume fraction control." Composite Structures 248: 112438. 10.1016/j.compstruct.2020.112438]

Alle Interessenten sind herzlich eingeladen.

Prof. Dr.-Ing. Thomas Böhlke
(Sprecher des GRK 2078)