



Characterising and Modelling Microstructural Organisation in Unidirectional Composites

Descriptor-Driven Microstructural Characterisation of Unidirectional Composite Materials

MSc thesis at TUDelft | Aerospace Structures and Materials | PAAM group

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Who we are

Within the Processing of Advanced Architected Materials (PAAM) group at TU Delft, we investigate how microstructural architecture influences processing, performance, and variability in composite materials. You will contribute to the development of next-generation tools for characterising and modelling fibre trajectories, defects, and morphological features relevant for aerospace-grade materials.

Your potential topic

Unidirectional composites exhibit complex microstructural features such as tortuosity, local waviness, filament bundling, clustering and variability across scales. Capturing these characteristics in a rigorous and reproducible way is essential for microstructure generation, quality assessment, and linking architecture to performance.

In this project, you will investigate how microstructural descriptors can be defined, refined and validated across multiple imaging scales using 3D CT data. Your goal is to establish robust, scale-aware descriptor sets that accurately represent fibre-level morphology and feed into PAAM's microstructure generator.

Aim

To develop, refine, and validate robust microstructural descriptors for unidirectional composites using multiscale 3D CT datasets.

Your potential tasks could include:

- Processing and filtering high-resolution and medium-resolution CT datasets of UD tapes and laminates
- Extracting fibre trajectories and computing descriptors such as tortuosity, orientation spread, bundling effects, network entanglement, and spacing
- Assessing descriptor sensitivity to noise, resolution, and segmentation artefacts
- Identifying descriptor limitations and proposing improvements based on physical insights

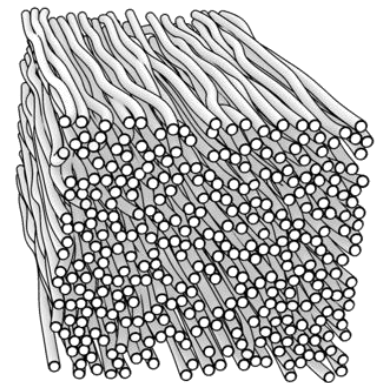


Figure: Reconstructed fibre trajectories from X-ray Computed Tomography data.

We are looking for you

You are a motivated MSc student in Aerospace Engineering, Mechanical Engineering, Materials Science, Computer Science or a related field. No prior experience with X-ray CT data is required: what matters is



curiosity, a hands-on approach, and interest in composite materials, image processing, and microstructural analysis.

What we offer

You will work as part of the PAAM group within TU Delft's Faculty of Aerospace Engineering. You will receive close guidance in X-ray CT processing, descriptor development, and data analysis. You will also have the opportunity to contribute to research publications or conference presentations.

The topic is part of ongoing ASM research projects and is directly linked to a Postdoc project at TU Delft, ensuring close academic supervision and integration into the PAAM research group of Prof. Clemens Dransfeld (paam-lab.org).

Next steps

If this opportunity has sparked your curiosity, please contact Silvia via email or LinkedIn. We look forward to hearing from you.

