Associate Professorship of Computational Mechanics and Professorship of Wood Technology
Department of Geo, Civil and Environmental Engineering
Technical University of Munich

HFM TUM

Modeling: ★★★★☆
Mathematics: ★★★☆☆
Programming: ★★★★☆
Science: ★★☆☆☆

Software Lab:

Development of the failure criteria for composites

Setting

Most of the fibre composite materials have complex aniso-tropic mechanical behaviour. This means that they behave differently under tension or compression and their properties vary in different coordinate directions. They have brittle failure under some loading conditions where the definition of a limit for maximum stress is an important point, whereas they have ductile behaviour under other loading conditions where the maximum strain limit plays an important role in defining the failure criteria. Although basic models for prediction of the failure are available in commercial FE-codes, they are only capable to cover some aspects of the complex material behaviour especially in 3D cases. User-defined models are needed to extend the basic models for more complex scenarios. Moreover, having a good knowledge about these materials will ease the prediction of the post elastic behaviour for other fibrous materials. Therefore, the application of the developed material model can be extended for other materials as well.

Filament wound tube before and after

Fracture mode in a single UD-

Source: A. Berger, 2014, Numerical Modeling of Composite Materials based on a combined manufacturing crash simulation, PhD, Queen Mary

Task

- Literature review about different available failure criteria for 3D composites
- Implementation of these criteria to describe the failure in composites
- Extend an existing anisotropic material model for the failure behaviour of composite
- Comparison of the results of different cases

Software to use

- LS-DYNA or ABAQUS
- FORTRAN for user-defined material modelling

Supervisors

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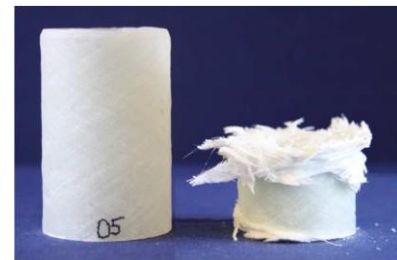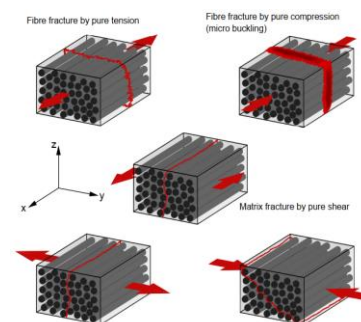Prof. Fabian Duddeck, Computational Mechanics Group, duddeck@tum.de

References

[1] Johns, R.M., Mechanics of Composite Materials, 2nd Edition, McGraw Hill, 1999.
[2] Berger A., Numerical Modeling of Composite Materials based on a combined manufacturing crash simulation, PhD, Queen Mary, 2014.