

Bachelor's Thesis, Term Project, Master's Thesis

Multiscale characterisation of mechanical and structural properties of glass fibre reinforced thermoset composites

A typical design lifetime of wind turbines is 20 years. During these years, they are exposed to harsh environmental conditions such as constantly varying wind loads, temperature and humidity changes, and also suffer from cyclic fatigue loads arising from their own weight in operation. As a consequence, blades, which are primarily made out of composites (Figure 1), are one of the most vulnerable components in the entire wind turbine system. In order to predict the failure of wind turbine blades and extend their service life, it is imperative to understand the damage mechanisms occurring in them, both during their manufacturing and in operation. To this end, a thorough investigation of the mechanical material performance at the micro, meso and macro levels is required (Figure 2).

Thus, the main goal of this work is the multiscale material characterisation of glass fibre reinforced thermoset composites, which are widely used for manufacturing wind turbine blades. Experiments to be performed include standard test methods such as tension/compression as well as more challenging fracture mechanics tests. In addition, analytical models will be applied for the prediction of experimental results. The tasks and workload of this study will be adapted to the type of work you choose: Term Project, Bachelor's or Master's Thesis.

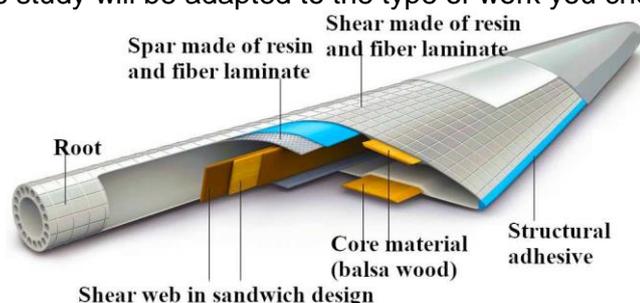


Figure 1: Structure of a wind turbine blade (Oliveira2020)

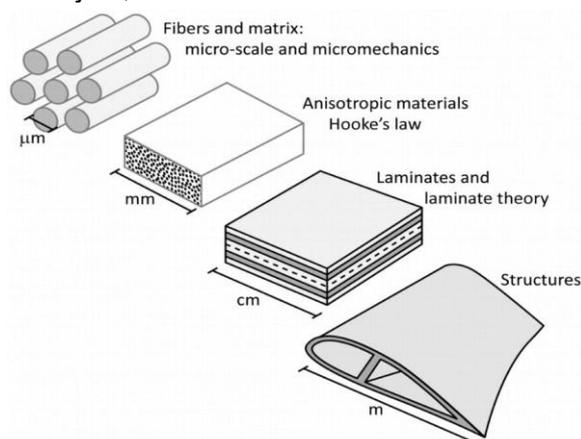


Figure 2: Multiscale approach of the material characterisation (Rokvam2018)

Research focus of the thesis

- Literature research: glass fibre reinforced thermoset composites, non-crimp fabrics, multiscale analysis, test methods and standards, resin infusion, manufacturing defects
- Specimen manufacturing and testing
- Microscopic analysis
- Data evaluation, analysis and documentation

Requirements

- Basic knowledge of composite materials and solid mechanics
- Interest in a practical work
- B2 level English
- Desire to learn and understand the topic
- Structured and independent work ethic

Starting date: Now

For more details please contact:

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