Introduction

Wind turbine blades must endure a variety of weather conditions including uncontrollable, extreme winds without developing damage and fracture during a lifetime of minimum 20 years. The variety of loading leads to multi-axial loading resulting in complex states of stress.

Methods

• Analysing wind turbine blade structures subjected to different load cases
• Characterising areas particularly exposed to multi-axial loading
• Investigation of the ability of different state-of-the-art failure criteria to predict failure under multi-axial loading
• Developing and performing sub-structure tests for multi-axial loading
• Creating analytical and / or numerical models to predict failure

Problem in focus

• Multi-axial loading leads to complex states of stress
• Prediction of complex loading effects with existing failure criteria can be uncertain
• Damages and failures in wind turbine blades often occur earlier than expected
• According to the World Wide Failure Exercise - most of the leading failure theories often greatly differ from the critical final failure strength of multidirectional laminates
• The accuracy of curve-fitting criteria is often restricted to load and material combinations corresponding to those from which the fitted curves originate

Purpose of the project

• Investigation how multi-axial loading effects influence the ultimate strength of typical composite structures in wind turbine blades
• Studying the ability of different criteria to predict failure under multi-axial loading conditions
• Developing methods to perform reliable prediction of failure based on physics-based failure criteria

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