MASTER'S DISSERTATION AT STRUCTURAL MECHANICS

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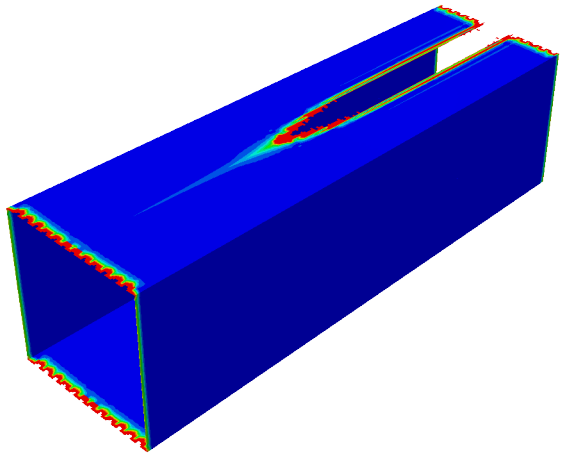
ANALYSIS AND DESIGN OF AN ADHESIVE JOINT IN WIND TURBINE BLADES



The demand for renewable energy is constantly increasing and in order to compete with other sources of energy the wind energy output has to increase. The power output from wind turbines are highly dependent on the swept radius of rotor blades. Increasing the length of the rotor blades will increase the weight of the blades, resulting in higher demands of the structural performance, but also introducing transportation issues. This has introduced the need for a lightweight blade structure which can be constructed in modules and then assembled at the site of construction. Such modular design requires high attention to the details of connections to make the structural performance desirable during its life time.

A proposed design for such a connection was studied with regard to stress concentrations when subjected to normal tensile stresses. The design was also optimized to utilize the material better by varying certain parameters to distribute the general stress level more evenly over the entire structure and avoiding local stress concentrations at the connection.

The optimum design was further investigated by considering failure in the adhesive material. Two different types of epoxy adhesives, one brittle and one ductile, were compared in terms of load capacity. A parametric study was also conducted to investigate in detail how different failure properties of the adhesive material will affect this load capacity.

It was shown that the investigated adhesive joint should be designed such that abrupt stiffness changes in the connection are minimized and transitions are made smoothly. It was also determined that a more ductile adhesive with a somewhat lower failure strength will yield a stronger joint than a more brittle adhesive with higher stiffness and strength.

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