STRUCTURAL OPTIMISATION OF WEB TO SPARCAP CONNECTION

Christian L. Nielsen, Christoffer L. Madsen, Frederik N. Hjorth, Niklas K. K. Stagsted and Nikolaj M. Bertelsen

1Department of Materials and Production, Aalborg University
Fibigerstraede 16, DK-9220 Aalborg East, Denmark
Email: {chrnie18,clma18,fhjort18,nstags18,nberte18}@student.aau.dk, web page:
http://www.mechman.mp.aau.dk/

Keywords: Composite structure, Wind turbine blade, Structural optimisation, Finite element analysis

ABSTRACT

This project aims to optimise the connection piece between the web and sparcap of an offshore wind turbine blade from Siemens Gamesa Renewable Energy. The objective is to maximise the strength of the connection to increase the overall load bearing capacity of the blade. This will be achieved through changes to either geometry, materials or design philosophy.

The sparcaps are the main supports for flapwise bending, while the web carries the shear loads and prevents the cross-section from collapsing. The connection piece is vital for connecting these structural elements and maintaining structural integrity, while providing tolerances for the placement and size of the web. The web is currently made of either balsa wood or PET foam with glass-fibre reinforced polymer as face sheets in a sandwich structure. The wings use sparcaps reinforced with carbon-fibre beams and the connection piece is typically made of wood or PET foam.

2D analyses of the current geometry will be used for the structural optimisation to determine the strength and ensure manufacturing and structural constraints are upheld. In addition, a new design concept will be proposed and optimised based on similar 2D analyses. A more advanced 3D model will be used to validate the optimised designs.

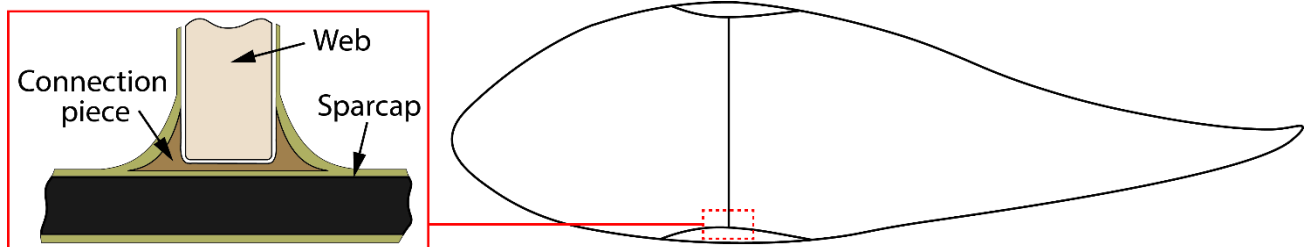This project is made in collaboration with Siemens Gamesa Renewable Energy.

Figure 1: Blade cross-section and web to sparcap connection.

Acknowledgement