A simplified model predicting the weight of the load carrying beam in a wind turbine blade

A simplified model predicting the weight of the load carrying beam in a wind turbine blade

Based on a simplified beam model, the loads, stresses and deflections experienced by a wind turbine blade of a given length is estimated. Due to the simplicity of the model used, the model is well suited for work investigating scaling effects of wind turbine blades. Presently, the model is used to predict the weight of the load carrying beam when using glass fibre reinforced polymers, carbon fibre reinforced polymers or an aluminium alloy as the construction material. Thereby, it is found that the weight of a glass fibre wind turbine blade is increased from 0.5 to 33 tons when the blade length grows from 20 to 90 m. In addition, it can be seen that for a blade using glass fibre reinforced polymers, the design is controlled by the deflection and thereby the material stiffness in order to avoid the blade to hit the tower. On the other hand if using aluminium, the design will be controlled by the fatigue resistance in order to make the material survive the 100 to 500 million load cycles experience of the wind turbine blade throughout the lifetime. The aluminium blade is also found to be considerably heavier compared with the composite blades.

General information
Publication status: Published
Organisations: Department of Wind Energy, Composites Mechanics and Materials Mechanics
Contributors: Mikkelsen, L. P.
Number of pages: 8
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: IOP Conference Series: Materials Science and Engineering
Volume: 139
Article number: 012038
ISSN (Print): 1757-8981
Ratings:
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.39 SJR 0.197 SNIP 0.555
Web of Science (2016): Indexed yes
Original language: English
Electronic versions:
Mikkelsen_2016_A_simplified_model_predicting_the_weight_of_the_load_carrying_beam_in_a_wind_turbine_blade.pdf
DOI:s:
10.1088/1757-899X/139/1/012038

Bibliographical note
Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI. Published under licence by IOP Publishing Ltd
Research output: Contribution to journal » Journal article – Annual report year: 2016 » Research » peer-review