Computational assessment of the DeepWind aerodynamic performance with different blade and airfoil configurations - DTU Orbit (07/12/2018)

An aerodynamic improvement of the DeepWind rotor is conducted adopting different rotor geometries and solutions with respect to the original configuration while keeping the comparison as fair as possible. The objective of this work is to find the most suitable configuration in order to maximize the power production and minimize the blade stress and the cost of energy. Different parameters are considered for the study. The DeepWind blade is characterized by a shape similar to the Troposkien geometry but asymmetric between the top and bottom parts. The blade shape is considered as a fixed parameter in the optimization process and, because of different blade element radii, it will experience different tip speed ratios in the same operational condition. This leads to a complex optimization problem, which must be carefully analyzed in order to find the most suitable parameter set. The number of blades in the analysis is varied from 1 to 4. In order to keep the comparison fair among the different configurations, the solidity is kept constant and, therefore, the chord length reduced. A second comparison is conducted by considering different blade profiles belonging to the symmetric NACA airfoil family. Finally, a chord optimization along the blade span is conducted, in order to find the optimal chord distribution to maximize the power production.

General information
State: Published
Organisations: Test and Measurements, Department of Wind Energy, Aerodynamic design, University of Padova
Contributors: Bedon, G., Schmidt Paulsen, U., Aagaard Madsen, H., Belloni, F., Raciti Castelli, M., Benini, E.
Number of pages: 9
Pages: 1100–1108
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Applied Energy
Volume: 185
Issue number: 2
ISSN (Print): 0306-2619
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 8.44 SJR 3.162 SNIP 2.765
Web of Science (2017): Impact factor 7.9
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.78 SJR 3.011 SNIP 2.61
Web of Science (2016): Impact factor 7.182
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 6.4 SJR 2.835 SNIP 2.593
Web of Science (2015): Impact factor 5.746
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 6.93 SJR 3.158 SNIP 3.218
Web of Science (2014): Impact factor 5.613
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 6.59 SJR 3.06 SNIP 3.346
Web of Science (2013): Impact factor 5.261
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 5.69 SJR 2.778 SNIP 3.076
Web of Science (2012): Impact factor 4.781
ISI indexed (2012): ISI indexed yes