



Aalborg Universitet

AALBORG UNIVERSITY
DENMARK

Reliability Analysis of Wind Turbines

Toft, Henrik Stensgaard; Sørensen, John Dalsgaard

Published in:
Ikke angivet

Publication date:
2008

Document Version
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):
Toft, H. S., & Sørensen, J. D. (2008). Reliability Analysis of Wind Turbines. In *Ikke angivet* Department of Civil Engineering, Aalborg University.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal -

Take down policy

If you believe that this document breaches copyright please contact us at vbn@aub.aau.dk providing details, and we will remove access to the work immediately and investigate your claim.

Reliability analysis of wind turbines

Henrik Stensgaard Toft, Aalborg University

John Dalsgaard Sørensen, Aalborg University and Risø/DTU

Session Theme:

Reliability-based design optimisation

Abstract: (239 words)

For minimising the total expected life-cycle costs of a wind turbine it is important to be able to estimate the reliability level for all components in the wind turbine. This paper deals with reliability analysis for different structural components in a wind turbine under different limit states.

For the wind turbine tower and blades representative limit state functions are formulated for typical structural failure modes. From these limit state equations the reliability level for the tower and blades can be estimated under both extreme and operational conditions. For wind turbines, where the magnitude of the loads is influenced by the control system, the ultimate limit state can occur under both extreme and operational loading.

The representative structural failure modes include both fatigue and ultimate limit states. Especially for the fatigue limit state the loading is dependent on whether the wind turbine is placed alone or in a wind farm, where wake effects from the neighbouring wind turbines must be taken into account.

The limit state equations are dependent on a number of parameters which must be modelled by stochastic variables. The distribution and distribution parameters for these stochastic variables are, when possible, based on the “Probabilistic Model Code” by Joint Committee on Structural Safety.

Illustrative examples show the reliability level for the wind turbine towers and blades obtained for different failure modes where the design is determined according to the wind turbine standard IEC 61400-1 “Wind turbines – Design requirements”.