



ELSEVIER

Contents lists available at ScienceDirect

Data in Brief

journal homepage: www.elsevier.com/locate/dib



Data Article

Normalized performance and load data for the deepwind demonstrator in controlled conditions



L. Battisti^a, E. Benini^a, A. Brighenti^a, M. Raciti Castelli^{a,*},
S. Dell'Anna^a, V. Dossena^b, G. Persico^b, U. Schmidt Paulsen^c,
T.F. Pedersen^c

^a Dipartimento di Ingegneria Civile Ambientale e Meccanica, Università di Trento, Italy

^b Dipartimento di Energia, Politecnico di Milano, Italy

^c Technical University of Denmark, Risø Campus, Roskilde, Denmark

ARTICLE INFO

Article history:

Received 25 May 2016

Received in revised form

5 July 2016

Accepted 14 July 2016

Available online 20 July 2016

Keywords:

VAWT

DeepWind Project

Troposkien rotor

Skewed flow

Wind tunnel measurements

Wind turbine benchmark data

ABSTRACT

Performance and load normalized coefficients, deriving from an experimental campaign of measurements conducted at the large scale wind tunnel of the Politecnico di Milano (Italy), are presented with the aim of providing useful benchmark data for the validation of numerical codes. Rough data, derived from real scale measurements on a three-bladed Troposkien vertical-axis wind turbine, are manipulated in a convenient form to be easily compared with the typical outputs provided by simulation codes. The here proposed data complement and support the measurements already presented in “Wind Tunnel Testing of the DeepWind Demonstrator in Design and Tilted Operating Conditions” (Battisti et al., 2016) [1].

© 2016 Published by Elsevier Inc. This is an open access article under the CC BY license

(<http://creativecommons.org/licenses/by/4.0/>).

DOI of original article: <http://dx.doi.org/10.1016/j.energy.2016.05.080>

* Corresponding author.

E-mail address: marco.raciticastelli@unitn.it (M.R. Castelli).

<http://dx.doi.org/10.1016/j.dib.2016.07.029>

2352-3409/© 2016 Published by Elsevier Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Specifications Table

Subject area	Physics
More specific subject area	Wind engineering
Type of data	Tables, graphs, figure
How data was acquired	Precision torquemeter, absolute encoder, 2 full strain gauge bridges
Data format	Filtered and analyzed
Experimental factors	Raw data are normalized using coefficients typically adopted in wind turbine engineering
Experimental features	Open jet wind tunnel and high precision test bench
Data source location	Trento, Italy
Data accessibility	All the data are presented in this article

Value of the data

- The primary objective of the measurement campaign conducted on the DeepWind reduced scale demonstrator is to provide information needed to quantify the three-dimensional aerodynamic behavior of a Troposkien wind turbine in both design (i.e. upright) and tilted (up to 15° with respect to the vertical axis, as shown in Fig. 1) operating conditions to quantify the impact of the tilting angle.
- Contrarily to open field testing, the here presented data allow numerical researchers to develop and validate enhanced engineering models on the basis of full-scale measurements conducted in an environment free from pronounced inflow anomalies.
- Great care is adopted in the description of the presented experimental data, in order to provide a useful benchmark for numerical simulations.

1. Data

Aerodynamic raw data measured during the wind tunnel campaign were rotor torque (Q_{aero}), rotor thrust (both in the longitudinal direction T_X and in the transversal one T_Y), rotor rotational speed (ω) and wind tunnel speed (V_∞). These data are here presented in a convenient form typically adopted in wind turbine engineering. As a matter of fact, to provide more insights on rotor behavior, aerodynamic torque ($C_{Q,\text{aero}}$) and thrust (C_{TX} and C_{TY}) coefficients are provided in Tables 1–4, as a function of the equatorial Tip Speed Ratio (TSR_{eq}) computed at rotor equatorial diameter.

In order to disclose the influence of the blade Reynolds number (Re) on aerodynamic torque, power and thrust coefficients, Figs. 2–6 show a comparison between the data obtained at two rotor angular velocities, respectively 200 rpm ($Re = 1.38 \times 10^5$) and 300 rpm ($Re = 2.05 \times 10^5$).

2. Experimental design, materials and methods

The experimental campaign was conducted at the Politecnico di Milano (IT) large scale wind tunnel, characterized by a working section of 4.00 m width and 3.84 m height. The wind tunnel was operated in a “free jet” (open) configuration with a central section of 6.00 m length. Rotor torque and thrust measurements were taken using a high precision test bench, which was instrumented using a precision torquemeter (to provide rotor aerodynamic torque), an absolute encoder (to provide rotor angular velocity) and 2 full strain gauge bridges (to provide rotor aerodynamic thrusts in both the longitudinal direction and in the transversal one).

Both upright and 15° tilted rotor configurations were tested in the open jet wind tunnel, as schematized in Fig. 1, showing also the local coordinate system for the longitudinal (X) direction

Download English Version:

<https://daneshyari.com/en/article/6597504>

Download Persian Version:

<https://daneshyari.com/article/6597504>

[Daneshyari.com](https://daneshyari.com)