ZEPHYR

Towards a more efficient exploitation of on-shore and urban wind energy resources

Research and Innovation Action

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D5.3: Large onshore WT: documented public databases archived on ZENODO (T5.1)

Executive summary

This report presents a description of the public database published on ZENODO that contains geometrical and operational characteristics, and noise measurements of the SWT-2.3-93 wind turbine, which was used as a case of study of the benchmark large onshore wind turbine during the project zEPHYR. This report also presents the link to access the database and how to cite it.

Partner in charge: SGRE

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PU	Public	PU
PP	Restricted to other programme participants (including the Commission Services)	–
RE	Restricted to a group specified by the Consortium (including the Commission Services)	–
CO	Confidential, only for members of the Consortium (including the Commission Services)	–

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The ZEPHYR Consortium partner responsible for this deliverable has addressed all comments received. Changes to this document are detailed in the change log table below.

Change log

Date	Version number	Author/Editor	Summary of changes made
14/08/2023	v1.0	L. Botero-Bolivar	First draft
15/08/2023	v1.0	L. Botero-Bolivar	Final draft submitted for review
09/10/2023	v1.0	J. Christophe	Final review

Table 1: Operating Conditions (OC) simulated.

	OC1	OC2	OC3
Rotor speed [rpm]	13	14	17
Pitch angle [°]	3	-2	5
Wind speed at 80 m [m/s]	6	8	9.5

1   Short description of the benchmark and case of study

The project zEPHYR aims at analyzing the effect of installing wind turbines in complex terrains and urban areas. One of the main objectives of the project is to develop prediction methods that consider the real environmental conditions where the wind turbines are placed, such as the turbulence intensity or the strong flow gradients. Therefore, the "Benchmark 5.1: Large onshore WT" of the project aims to present an unique case of study in which the ESRs can apply the methodologies developed in their own project. Furthermore, this benchmark helps to compare the different approaches, algorithms, and numerical and experimental methods.

The benchmark is divided in two main parts. In the first part, the objective is to define a case of study with enough available literature to compare the results obtained by the ESRs. In the second part, the objective is to calculate the wind turbine aerodynamic and acoustic performance using several methodologies developed by the ESRs and compare the results.

The main result of the first part of the benchmark is a public database, compiling different sources from literature on a large horizontal axis wind turbine. The case of study is a Siemens SWT-2.3-93, which is located in the Høvsøre Wind Turbine Test Center in Denmark, for which the met mast data are also available for the corresponding time period. Even if the geometry and the operating curves are not available, good approximate models for the STW-2.3-93 WT are available in literature.

2   Content of the public Database

The database contains information about the wind turbine geometry and operational condition, such as:

- swt2.3-93_blade_geometry_spanwise_distribution.json: spanwise distribution of chord, twist angle and used profiles

- XXX_profile_coordinates.json: non-dimensional profile coordinates where XXX is the profile name

- swt2.393_operating_curves.json: wind turbine operating curves, rotational speed and blade pitch angle vs. wind speed

- swt2.393_power_curve.json: power curve

1/3 Octave band Sound Power Level measured at 100m downstream of the SWT-2.3-93 wind turbine are available for three operating conditions (OC), summarized in Tab. 1. The data contains the center frequency and L_W in dBA. The operational conditions are shown in the name of the file.

The weather information includes temperature, wind direction, wind speed, relative humidity, and pressure at several heights. The files includes the timestamp and the measured value.

The database includes scripts to generate figures of the operational conditions of the wind turbine:

- read_plot_database.py: python script producing figures (tested on python 3.8)

- figures_layout.mplstyle: used style parameters to produce the figures

The folders are organized in the following way:

- acoustic: sound measurements

- turbine: geometrical information on the SWT2.3-93 wind turbine

- weather: met mast measurements

- CAD : 3D CAD geometry reconstructed from turbine folder

3   Availability of the database

The database is part of the zEPHYR ZENODO community (https://zenodo.org/communities/zephyr/) and is directly accessible from https://zenodo.org/record/7323750.

The database should be cited as: *Christophe, Julien, Buckingham, Sophia, Schram, Christophe, & Oerlemans, Stefan. (2022). zEPHYR - Large On Shore Wind Turbine Benchmark (1.0) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.7323750*

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