The OST test turbine, Winterthur, Switzerland

General description of turbine

The wind turbine Taggenberg 1, type AV-7, is manufactured by Aventa AG in Switzerland and was commissioned in December 2002. The turbine is operated via a belt-driven generator and a frequency converter with a variable speed drive. The rated power of the Aventa AV-7 is 6.5 kW, beginning production at a wind speed of 2 m/s and having a cut-off speed of 14 m/s. The rotor diameter is 12.8 m with 3 rotor blades. The maximum rotational speed of the turbine is 63 rpm.

The site-specific average annual wind speed at hub height is approx. 3.0 m/s, resulting in an electricity yield of approx. 10,000 kWh/a.

We have built an OpenFAST model of the wind turbine and have integrated this in a cloud deployed aerodynamic digital twin for use in research projects.

Location of site

The wind turbine is located in Taggenberg, about 5 km from the city centre of Winterthur, Switzerland. This site is easily accessible by public transport and on foot with direct road access right next to the turbine. This prime location reduces the cost of site visits and allows for frequent personal monitoring of the site when test equipment is installed.

The coordinates of the site are: 47°31'12.2"N 8°40'55.7"E

Control and measurement systems and signals

The wind turbine is controlled via a pitch control system based on the rotor speed. The pitch is measured on the linear drive, with the signal being converted into an angular value of the blade. Since the turbine is utilised in various applied research projects, it is equipped with numerous sensors, such as vibration sensors, microphones and acoustic arrays. The environmental conditions at the site are monitored, including wind direction and speed, temperature, pressure and humidity.

Additionally, the SCADA parameters are stored at a frequency of 1 Hz and displayed in a user-friendly cloud-based dashboard with data export function to simplify their analysis.

Research possibilities

The wind turbine is ideal for testing measurement technology in the field due to its easy access and low height. As the turbine has most of the features of a large wind turbine but is easily accessible, prototype sensors and measurement equipment can be installed at a fraction of the cost compared to a large MW wind turbine.

Some example projects that have been tested on this turbine include:

Aerosense

The aim of this project is to develop a MEMS-based surface pressure and acoustic measurement system for wind turbines that is thin, non-intrusive, robust, modular, energy-autonomous, wireless, easy to install and cost-effective. The system will integrate novel embedded signal processing solutions, including artificial intelligence where appropriate, for on-board calibration and correction of measured variables, as well as a digital twin platform for effective data utilisation and value creation. Its modular and scalable design will enable wind turbine monitoring at a completely new scale (https://www.aerosense.ai/).

Netico

The aim of this project is to develop an innovative, non-intrusive, sensor box and cloud-connected diagnostic system that will help asset owners/operators improve their workflow and maximise their revenues. The system will be based on the Swiss company Netico's existing technology that uses acoustic sensors and will be enhanced with novel machine learning approaches.

The project consists of (a) designing and testing a diagnostic system in the laboratory, (b) developing novel machine learning approaches for increasing the efficiency and effectiveness of the measurements, (c) combing these results into a prototype system and carrying out a proof of concept on a running wind turbine, and (d) developing recommendations for applying the solution to industrial machines in general.

Contact data and more information

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