Calibration of a spinner anemometer for yaw misalignment measurements

The spinner anemometer is an instrument for yaw misalignment measurements without the drawbacks of instruments mounted on the nacelle top. The spinner anemometer uses a non-linear conversion algorithm that converts the measured wind speeds by three sonic sensors on the spinner to horizontal wind speed, yaw misalignment and flow inclination angle. The conversion algorithm utilizes two constants that are specific to the spinner and blade root design and to the mounting positions of the sonic sensors on the spinner. One constant, \( k_2 \), mainly affects the measurement of flow angles, while the other constant, \( k_1 \), mainly affects the measurement of wind speed. The ratio between the two constants, \( k_\alpha = k_2/k_1 \), however, only affects the measurement of flow angles. The calibration of \( k_\alpha \) is thus a basic calibration of the spinner anemometer. Theoretical background for the non-linear calibration is derived from the generic spinner anemometer conversion algorithm. Five different methods were evaluated for calibration of a spinner anemometer on a 500 kW wind turbine. The first three methods used rotor yaw direction as reference angular, while the wind turbine, was yawed in and out of the wind. The fourth method used a hub height met-mast wind vane as reference. The fifth method used computational fluid dynamics simulations. Method 1 utilizing yawing of the wind turbine in and out of the wind in stopped condition was the preferred method for calibration of \( k_\alpha \). The uncertainty of the yaw misalignment calibration was found to be 10%, giving an uncertainty of 1° at a yaw misalignment of 10°. © 2014 The Authors. Wind Energy published by John Wiley & Sons, Ltd.

General information
State: Published
Organisations: Department of Wind Energy, Test and Measurements, Aeroelastic Design
Contributors: Friis Pedersen, T., Demurtas, G., Zahle, F.
Pages: 1933–1952
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: Wind Energy
Volume: 18
ISSN (Print): 1095-4244
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.18 SJR 1.051 SNIP 1.834
Web of Science (2017): Impact factor 2.938
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.37 SJR 1.079 SNIP 2.316
Web of Science (2016): Impact factor 2.725
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.06 SJR 1.201 SNIP 2.165
Web of Science (2015): Impact factor 2.891
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.42 SJR 1.209 SNIP 3.688
Web of Science (2014): Impact factor 3.069
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.75 SJR 1.235 SNIP 2.486
Web of Science (2013): Impact factor 2.556
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.36 SJR 1.062 SNIP 2.297
Web of Science (2012): Impact factor 1.436
ISI indexed (2012): ISI indexed yes