Calibration of a spinner anemometer for wind speed measurements

The power curve of a wind turbine can be measured, according to IEC 61400-12-2 with a nacelle-mounted anemometer. Typically, a sonic anemometer or a cup anemometer and a wind vane are mounted on the back of the nacelle roof. Another option is to use a spinner anemometer. The measurement principle of the spinner anemometer is based on the flow distortion caused by the wind turbine spinner. The flow on the spinner surface is measured by means of three 1D sonic sensors mounted on the spinner and a conversion algorithm to convert the wind velocity components measured by the three sonic sensors to horizontal wind speed, yaw misalignment and flow inclination angle. The algorithm utilizes two calibration constants that are specific to the spinner shape, blade root design and to the mounting positions of the sonic sensors on the spinner. The present analysis describes methods to determine the calibration constant related to wind speed measurements. The first and preferred method is based on the definition of the calibration constant and uses wind speed measurements during the stopped condition of the wind turbine. Two alternative methods that did not require the turbine to be stopped were investigated: one used relatively high wind speed measurements during normal operation of the wind turbine, while the other one used a CFD simulation of the flow over the spinner. The method that entails stopping the turbine in good wind conditions showed the best results and is recommended. The evaluation of uncertainty was not included in the present analysis.