Abstract

The herein presented novel approach to determine rotary speed and position in wind power plants uses a unique non-contact magnetic principle without bearing, free from wear, adaptable in any order to largest turbine shafts, while still offering a high resolution of more than 100,000 ppr for low speed shafts. The described approach offers complete flexibility and, in any case, easy and compact solution to monitor shaft speeds of shaft diameters up to several meters.

In this poster presentation we would like to share the concept of this unique magnetic speed and position measuring technique integrated in the control system. First, we will explain the encoder design and setup. Second, we provide an overview of the encoder signal processing adapted to the special needs in wind power plants. Afterwards, we will explain the benefits and restrictions of the encoder system based on recorded measurement results. The readers will learn about a solution for a speed and position measurement technique applied on large shafts that offers high resolution, flexibility and quality.

Objectives

To increase the efficiency of wind turbines it is essential to measure the speed and position of rotor and generator shafts. These figures are a prerequisite for an effective control of wind power plants. Integrated in the plant’s control system, rotary encoders provide the necessary state variables for a diversity of plant functions, such as individual pitch control, turbine control and rotor positioning. In all cases the applied rotary encoders are exposed to most demanding operating and roughest environmental conditions. Furthermore, the encoder needs to adapt to the large spatial dimensions inside the wind turbine with its large shaft diameters.

Methods

The Baumer flexible tape encoder is based on a dual magneto resistive detection of the magnetic flux of a magnetized tape (Fig. 2).

The magnetic tape, can be fastened in flexible length onto any wind turbine shaft, just like a belt, and tightened with a locking system nut.

Results

When one magneto resistive sensor is coming close to the gap in the locking system it is recognized by the signal processing unit (FPGA). The output signal is then provided by the signal from the second magneto resistive sensor.

High quality rectangular SSI position and speed signals are generated and made available via the flexible encoder interfaces.

Conclusions

The Baumer tape encoder offers complete flexibility and combines high resolution and accuracy with easy installation, compact dimensions and a free from wear solution to monitor shaft speeds of shaft diameters up to several meters.

The magnetic tape encoder is suitable not only for new wind turbine designs, but also provides the possibility for adding another speed or position acquisition system in existing wind power plants. The encoder is capable for control as well as measurement purposes.