Design of Highly Loaded Slewing Bearings - The Collaborative Project HBDV

Jae-Il Hwang(jaeil@gmx.de), Torben Terwey, Gerhard Poll

Institute of Machine Design and Tribology, Leibniz University Hannover, Germany

Abstract

Most modern wind turbines are designed for a service life of 20 years. The size of turbines has increased within the last years but, however, the load density as well. new functional concepts and advanced control strategies are utilized to increase energy yield and reduce levelized costs of electricity. Complex load conditions are the result, leading to early failures of machine components and subsequently to high maintenance costs.

For an efficient operation of wind turbines, the rotor and its blades have to be adjusted dynamically to environmental conditions. Most common nowadays is the so called Individual Pitch Control (IPC) , which means a dynamic adjustment of blade angles (pitch angles) to the wind conditions considering respective positions during one revolution. Unfortunately, IPC causes a continuously and dynamic change of load for blade supporting pitch bearings. Occurring oscillating movements are leading to insufficient lubrication conditions and resulting damage mechanisms. Depending on load, oscillation angle and frequency and other parameters, bearings can thus fail long before the intended service life. Most common failure mechanisms are false brinelling, fretting corrosion and premature rolling contact fatigue.

The publicly funded research project Highly Loaded Slewing Bearings (HBDV) deals with the investigation and the prediction of these damage mechanisms with the focus on pitch bearings. Within the project, a guideline for the prevention of early failures regarding different working conditions and load scenarios will be developed. The research consortium consists of five German institutes: The Institute of Machine Design and Tribology (Leibniz University Hannover, Germany), the Fraunhofer Institute for Wind Energy Systems (Hamburg, Germany), the Chair for Wind Power Drives (RWTH Aachen University, Germany), the Leibniz Institute for Materials Engineering (Bremen, Germany) and the Institute for Plant Engineering and Fatigue Analysis (TU Clausthal, Germany). The collaborative project is supported by the German Federal Ministry for Economic Affairs and Energy and four of the leading wind turbine manufacturers: Nordex, Vestas, GE and Senvion.

Keywords: *wind turbine, pitch control*

Biography

Oct. 2018 Diplom - Ingenieur in Mechanical Engineering, Gottfried Wilhelm Leibniz University Hannover, Germany

Since Jan. 2019 Research assistant by Institute of Machine Design and Tribology in Leibniz Universiy Hannover with focus on wind turbine bearings, in Gemany