



Fraunhofer IWES

FRAUNHOFER INSTITUTE FOR WIND ENERGY AND ENERGY SYSTEM TECHNOLOGY IWES



1 The modular composition of the test stands allows testing of different main shaft designs

2 The components are constructed for 2-5 MW turbines

Photos: Martina Buchholz

MAIN SHAFT FATIGUE TEST BENCH

For the first time in Germany a test bench for wind turbine main shafts is accessible to the public at Fraunhofer IWES. With this test bench it is possible to simulate 20 years of main shaft operation time within half a year of testing.

Appropriate Test Bench Design

The aim of the fatigue tests is not only to damage the specimen, rather it is important to reproduce a realistic loading and thus wear and tear as occur in operational wind turbine main shafts. For this reason we have conducted a detailed analysis of simulated and measured load time series for the main shaft. After processing the data using the „Rain-Flow-Counting“ method, lifetime damage was calculated based on Miner’s rule. An important output of those analyses is the information on which degrees of freedom are relevant for fatigue damage mechanisms and thus helping us to design an adequate test bench.

The „BeBen“ Project

„BeBen“ is the title of a long term collaborative research project involving Hamburg University of Applied Sciences (HAW), Suzlon Energy and Fraunhofer IWES, funded by the Federal Ministry for Economic Affairs and Energy. „BeBen“ is a German abbreviation and can be translated as accelerated experimental endurance strength verification for large wind turbine components using the example of main shafts. The project’s major aims can be summarized as:

- Comparison of theoretical and experimental endurance strengths
- Adjustment of certification guidelines
- Material savings

Some highlights of the project scope:

- Material tests (s-n curve, impact test)
- Development and acquisition of a main shaft fatigue test bench
- Full scale main shaft fatigue tests

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Supported by:



Federal Ministry
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on the basis of a decision
by the German Bundestag



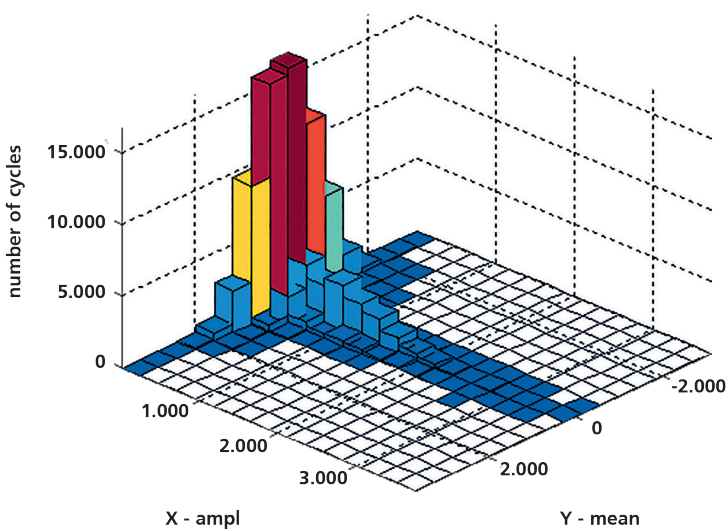
Services

- MBS and FEM modeling
- Damage calculation
- Design optimization with different focuses
- Test campaign planning
- Main shaft full-scale testing under realistic conditions
- Experimental model verification
- Measurement campaigns
- Component s-n-curves determination
- Certification process support

Technical data

- Max. bending moment: 15 MNm
- Max. radial force: 3 MN
- Max. rotational speed: 60 rpm
- Drive power: 300 kW
- Heavy-duty foundation
- Flexible test arrangements possible

Rain-Flow Matrix



Main shaft stress distribution

