



Analytical Fatigue Life Assessment of a Full Scale Wind Turbine Test Bench

PhD student: Nimai Domenico Bibbo
University supervisor's: Vikas Arora, Anders Brandt
Company supervisor: Torben Lorentzen
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BACKGROUND

Lindø Offshore Renewables Center (LORC) owns and operates two wind turbine test benches, a HALT (Highly Accelerated Life-time Test) Test Bench shown in Figure 1 and a Function Test Bench shown in Figure 2.

HALT Test Bench

- Performs life-time testing of turbine nacelles.
- Torque loads in excess of 14MNm.
- Tilt/yaw moments in 25MNm range.
- Wind turbines up to 10MW rating.

Function Test Bench

- Functionality and grid compliance tests on turbine nacelles.
- Torque loads in excess of 12MNm.
- Wind turbines up to 10MW rating.

Both test benches are subjected to large loads during turbine testing, both extreme and fatigue.

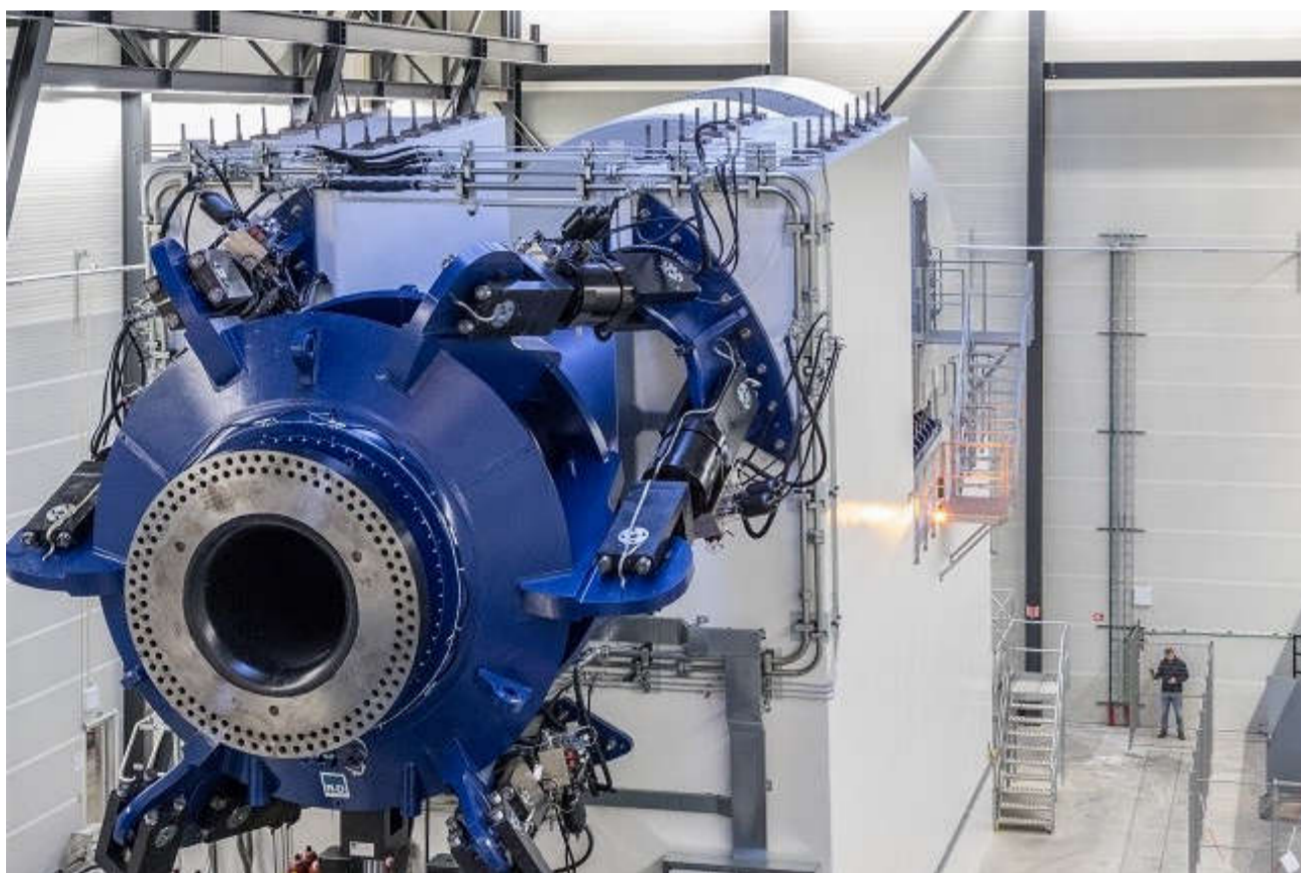


Figure 1: HALT Test Bench installation at LORC, for scale an employee can be seen to the right of the test bench.

OBJECTIVES

The objective of the project is to establish a digital model of critical components of LORC's wind turbine test benches. To accomplish this the following methods will be applied:

- Finite Element Models of critical components.
- Identification of stress hot spots.
- Sub structuring techniques for model optimization.
- Damping identification and damping matrix updating from EMA (Experimental modal analysis).
- Analytical fatigue life assessment of critical components and stress hot spots.
- Collaboration with sister project "Analytical Fatigue Life Assessment of a Full Scale Wind Turbine Test Bench".



Figure 2: Function Test Bench installation at LORC, a Vestas turbine can be seen installed on the test bench.

CONTRIBUTION

The analytical assessment of the test benches will provide LORC with a set of analytical tools for predicting life time degradation before future test campaigns:

- Finite element models of critical components.
- MATLAB GUI for fatigue life prediction and remaining life assessment based on load inputs.

For LORC it is essential to keep track of the true residual lifetime as a function of loads imposed on the test bench, which will give an advantage with:

- Service and maintenance.
- Potential investments in lifetime extension.
- True depreciation period.
- Flexibility with load envelopes.

COMPANY

Lindø Offshore Renewables Center is a non-profit commercial foundation established in 2009 by some of the major players in the offshore renewable energy sector. Their objective is to promote innovation in the offshore renewable energy sector contributing to the lowering of the Levelized Cost Of Energy and make renewable energy viable offshore. Lindø Offshore Renewable Center focus on test and validation at their facilities at Lindø port of Odense. Activities span from manufacturing technologies and testing of structures and components to the full-scale testing of wind turbine generators.