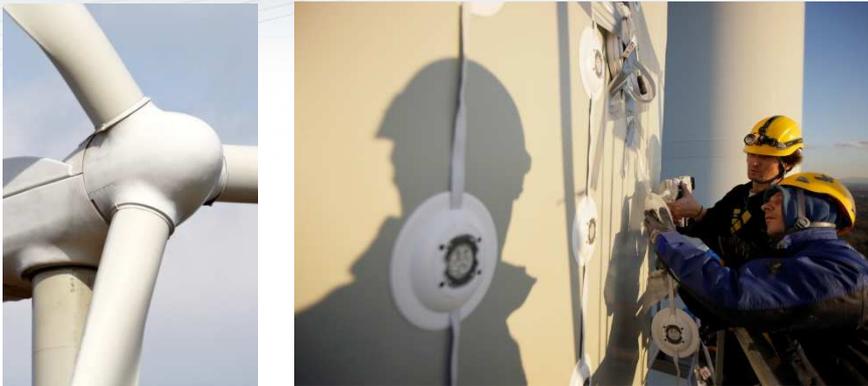


Modal Analysis on Wind Turbine

Measurement on the Gondola for model validation,

with *Ingeniería para el Control del Ruido (ICR)*



ICR, Engineering for the Noise Control, is a company dedicated to resolving problems of noise and vibrations.

Industrial necessities are always taken into account and feasible solutions at a viable cost turn out to be their goal. This premise is applied to every field they work in, always providing the latest analysis methods and developing new technology if necessary.

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Acoustic impact study in the chemical plant - ICR

Introduction

The objective of this application is to establish **the dynamics of a gondola of a wind turbine**. As a first step, a finite elements model has been created to simulate the vibratory behaviour of the cabin. To validate this numerical model, experimental measurements are made on a prototype. As the study is restricted to the low frequencies, the best methodology to characterize the gondola behaviour is **Experimental Modal Analysis**.

This method enables to obtain experimentally the first modes of vibration, i.e. for each mode its mode shape, Eigen frequency and damping. These modes describe the dynamics of the gondola in the frequency range of interest.

OR38 System

- > Made for the field
- > Up to 32 Channels
- > Rugged, Rough, Reliable
- > Portable
- > Comprehensive FFT plug-in: Triggers, weighted windows, cross functions
- > Accurate: ± 0.02 dB/ $\pm 0.02^\circ$



OROS MODAL 2 software

Modern and user-friendly software with specific modules:

- > Geometry building
- > Operating Deflection Shape in time and frequency domain
- > Modal Indicator functions
- > MIMO identifications methods for EMA & OMA
- > Modal Validation tools (MAC)



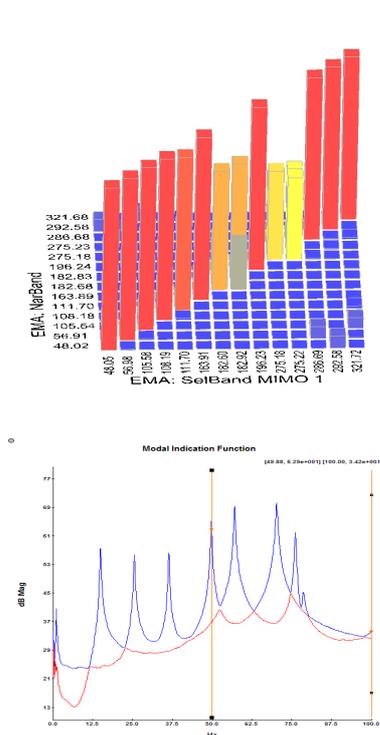
Structure under test

The tested gondola corresponds to a large wind turbine model (more than 100 m high). During the test, the gondola is not assembled with the tower neither with the blades. The measurements take place in the assembly plant.

Test configuration

The position of the transducers is defined from the numerical mesh and finally 24 nodes will be instrumented in the 3 directions. Practically, **6 tri-axis accelerometers** are fixed in the structure which is excited on the 24 nodes by an **impact hammer**. These transducers are connected to an **OROS OR38, 32 channels**. The Frequency Response Functions between the excitation and the responses are measured. The coherences are displayed during the acquisition to validate the correct impact.

Modal Identification and Validation



The data acquisition and analysis are realized with **NVGate[®]** and **OROS Modal 2**. First, the Modal Indicator Function (MIF) gives information about the position of the first modes. Then, modal identification methods, including the Rational Fraction Orthogonal Polynomial method (RFOP), are used to calculate the modal parameters.

Several indicators are calculated for modal data validation:

- The mean phase deviation (MPD). This index is the statistical variance of the phase angles for each mode shape coefficient for a specific modal vector from the mean value of the phase angle.
- A comparison between synthesized FRFs and measured ones.
- The Modal Assurance Criteria (MAC). These values are an indication of the correlation between the modes.

Conclusion

Thanks to the complete integration between the analyzers and OROS Modal 2, the OROS structural solution is the perfect tool for efficient and safe tests in the field. This powerful and user friendly instrument allowed here to determine the experimental modes of the gondola and so to validate the numerical model with high accuracy in a minimum of time.

OROS, Leadership through Innovation

About Us

Now approaching 30-years in business, OROS' designs and manufacturing have been renowned for providing the best in noise and vibration analyzers as well as in specific application solutions.

Our Philosophy

Reliability and efficiency are our ambition everyday. We know you require the same for your measurement instruments: comprehensive solutions providing performance and assurance, designed to fit the challenges of your demanding world.

Our Emphasis

Continuously paying attention to your needs, OROS collaborates with a network of proven scientific affiliates to offer the latest of the technology, always based on innovation.

Worldwide Presence

OROS products are marketed in more than 35 countries, through our authorized network of representatives, offices and accredited maintenance centers.

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