Case Study
TMD.Tower prevents vortex induced tower vibrations

Initial Situation

Today’s slender and high wind turbine towers are increasingly subject to vibrations, which are typically caused by wind and wave loads or rotor imbalances. The use of tuned mass dampers does not only reduce vibration amplitudes but has a major effect on fatigue load reduction and on the lifetime extension of wind turbine towers.

A leading German wind turbine OEM requested for Wölfel to develop and manufacture a solution for vortex induced vibrations (VIV) in the 2nd tower bending mode for turbines in wind farms across the world. The aim is to reduce critical fatigue loads during vortex shedding events. Relatively high tower frequencies above one hertz, a cost efficient design and fast delivery are only some of the challenges within this project.

Approach

Design of TMD.Tower

TMD.Tower is a made-to-measure system that may be adjusted to customer needs for specific wind turbine towers. It is adaptable to the required frequency and damping and can be scaled to account for different tower masses. The tuned mass damper is designed to be working only during critical vortex shedding events.

A nonlinear model is used to predict forces acting on the tuned mass damper and tower as well as their vibration amplitudes. These values work as input for finite element calculations and proof of structural integrity. Due to high dissipated vibration energy, thermal simulations are carried out to predict the heat distribution in the components.

Manufacturing is done in close cooperation with our partner company LISEGA SE that has more than 60 years of experience with large scale steel products in heavy industry. Before delivery, the entire TMD.Tower and its components are validated on a full scale test rig within our partner’s unique testing facilities.
Installation & Operation

The TMD.Tower systems are delivered in time to the construction site and installation is carried out during erection of the wind turbine tower. The tuned mass dampers are located in the maximum of the 2nd mode shape at approximately half the tower height and are now ready for operation.

Result

The development and manufacturing of the TMD.Tower systems could be finished on time and to the satisfaction of the customer. Wölfel proved to be a reliable partner, providing the entire scope of service from the design and proof of structural integrity on the one hand to the manufacturing and validation of large scale vibration reduction solutions on the other hand. With this economic solution, vibration problems and lifetime issues are solved before they occur.

“Thanks to the close and good coordination between Wölfel and my team, this challenging project was completed to our full satisfaction within a tight timeframe. Wishes and even short-term changes were taken into account and we will be happy to come back to Wölfel if the need arises.”

Head of Component Engineering at leading german wind turbine OEM

Development and Production Partner
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