Wind turbine wind damper

Can external dampers be used for fixed offshore wind turbines?
So far, research on the use of external dampers for fixed offshore wind turbines has focused mainly on passive concepts, with most focus on dynamic vibration absorber (DVA) concepts, such as a tuned liquid column damper or a tuned mass damper (TMD).

Can liquid dampers reduce wind turbine vibration?
Intensive research investigated the ability to use passive vibration control such as TMD, TLD, TLCD, and TLCGD in mitigating unwanted wind turbine vibrations over a significant range of frequencies since no energy is required . Marine vessels have used liquid dampers since the 1950s as anti-rolling tanks for stabilization issues.

Are tuned mass dampers effective in a wind turbine?
Frequency domain analysis of the wind turbine installed with d-MTMD by consideration of blade and SSI effect. The efficiency of tuned mass dampers (TMDs) in along-wind response mitigation of a wind turbine with consideration of blade coupling and soil-structure interaction (SSI) is investigated.

What is a tuned liquid damper?
A tuned liquid damper (TLD) is one of the most economically passive vibration control strategiesfor controlling the wind-induced vibrations of structures such as wind turbines (WT). The literature on fluid-structure interaction limits the scope of analysis to either the influence of wind on tower,or liquid on tank.

Are tuned liquid column dampers suitable for floating wind turbines?
The conclusion was reached by classifying and comparing,tuned liquid column dampers are often employed in operational conditions. Dampers with power sources perform well in extreme conditions,such as Magnetorheological dampers. Rotational inertia dampers can greatly decrease torque but have yet to be widely employedin floating wind turbines.

How can structural damping improve a wind turbine?
To increase the turbine's survivability,stability,and fatigue lifetime,researchers proposed various structural damping methods divided into four categories depending on the amount of energy consumed to control the main structure: passive,active,semi-active,and hybrid vibration controls.

ABSTRACT The problem of reducing the dynamic response, and thus the fatigue load, on a wind turbine tower is treated by introducing a mass damper. Investigations are performed using structural optimization on equivalent conditions with and without the damper. Overall effects are analyzed and valuable information is obtained through sensitivity analysis of the optimal ...

To verify the applicability of the decoupled optimization and the control effect of the circular liquid damper in a highly coupled wind turbine system, the optimized damper is incorporated into the 13-DOF model. For each blade, a circular liquid damper is mounted at the position of x 0 =45 m. Hence, a 16-DOF system is obtained for the wind ...

The authors found that TMDIs can control edgewise vibrations in wind turbine blades while requiring significantly less damp strokes than classical TMDs. Jahangiri and Sun (2022b) created an analytical model for wind turbine blades using a two-dimensional nonlinear tuned mass damper inerter (2D-NTMDI). The results indicate that the properly ...

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4 · Offshore wind power is widely recognized as a highly promising renewable energy source and has garnered significant interest worldwide (Zuo et al., 2020).According to the Global Wind Energy Council, the cumulative grid-connected offshore wind capacity was expected to exceed 60 GW by 2022 and is anticipated to reach 200 GW over the next five years (Anon., ...

Resonant vibrations in particular can be (cost-)effectively reduced by tuned mass dampers. In bridge construction, dampers have long been tried and tested. Wölfel has designed and delivered dampers for bridges already in the 1970s. In the wind energy sector, the demand for dampers has continuously increased over the past few years.

To effectively attenuate the adverse vibration of wind turbines, plenty of scenarios were put forward and studied, including passive control, semi-active control, and active control. 3 It is worth mentioning that wind turbines ...

A damping system using a passive damper, the Tuned Mass Damper (TMD), is designed and inserted in the Nacelle/Rotor of a monopile wind turbine (ref. NREL 5 MW). The dynamic behavior of the system is described by a differential equation of motion which is solved through the Newmark algorithm.

In this study, excitation tests are performed for a 2.4-MW horizontal axis wind turbine using an active mass damper (AMD) to identify the structural parameters for first and second modes. Two types of excitation test are performed to evaluate the damping ratios in both fore-aft and side-side directions. Finally, an empirical formula is proposed ...

As well, wake effect on wind turbine dampers is studied by comparing optimized dampers with and without consideration of wake. Optimized dampers can reduce at most 44% tower bottom equivalent fatigue load. Numerical results can provide references for choosing damper and damper optimization in real engineering.

T1 - Damping of wind turbine tower vibrations. AU - Brodersen, Mark Laier. PY - 2015. Y1 - 2015. N2 -

Damping of wind turbine vibrations by supplemental dampers is a key ingredient for the continuous use of monopiles as support for offshore wind turbines.

Offshore Wind Turbine Load Reduction Employing Optimal Passive Tuned Mass Damping Systems, IEEE Transactions on Control Systems Technology (2013) The Impact of Passive Tuned Mass Dampers and Wind-Wave Misalignment on Offshore Wind Turbine Loads, Engineering Structures (2014)

Recently, structural control has been investigated in offshore wind turbines, including floating turbines, using various kinds of tuned mass dampers (TMDs) such as translational tuned mass dampers ...

4 · Dampers with power sources perform well in extreme conditions, such as Magnetorheological dampers. ... Wind turbine (WT) with a long period is a dynamic sensitive but lightly damped structure ...

Investigation and optimization of a pre-stressed tuned mass damper for wind turbine tower. Struct Control Health Monit (2021), Article e2894. Google Scholar [13] Z. Lei, G. Liu, M. Wen. Vibration attenuation for offshore wind turbine by a 3D prestressed tuned mass damper considering the variable pitch and yaw behaviors.

Many countries are making plans to develop wind generation offshore as the wind resource is stronger and steadier at sea. 1 As wind and waves are highly fluctuating loads and offshore wind turbines (OWTs) are slender structures, their dynamics must be considered carefully. Damping is critical in correctly predicting the dynamic behaviour of an OWT because ...

Offshore wind power has been making a positive contribution to global energy transformation and climate change mitigation. The global offshore market grew on average by 21 % each year in the past decade, bringing total installations to 64.3 GW, which accounted for 7.1% of total global wind capacity as of the end of 2022 (Council, 2023).Offshore wind power is ...

This paper aims to reduce vibration in wind turbine towers using an active damper named the twin rotor damper (TRD). A single degree of freedom (SDOF) oscillator with the TRD is used to approximate the response ...

Tuned liquid column dampers in offshore wind turbines for structural control. Eng. Struct., 31 (2) (2009), pp. 358-368. View PDF View article View in Scopus Google Scholar. Dinh and Basu, 2015. V.N. Dinh, B. Basu. Passive control of floating offshore wind turbine nacelle and spar vibrations by multiple tuned mass dampers.

A fixed offshore wind turbine structure with an Active Tuned Mass Damper (ATMD) is illustrated in figure 1(a). The ATMD is positioned at the top of the wind turbine, where the amplitude of the critical tower modes are expected to be largest. In the initial design process, the wind turbine

Some methods employed in commanding MR dampers tested in wind turbines include ground-hook, sliding

mode, linear damping, nonlinear damping, and the adaptive control algorithms. Ref. [102] conducted simulations of the numerical models using MR damper equipped with tuned vibration absorber. MATLAB was used in the numerical analysis and the ...

The efficiency of tuned mass dampers (TMDs) in along-wind response mitigation of a wind turbine with consideration of blade coupling and soil-structure interaction (SSI) is ...

Tuned mass dampers (TMD) are widely used in buildings and other structures to reduce earthquake and wind-induced vibrations. However, the application of TMD in wind turbine (WT) structures is limited. Literature shows that the TMD for WT is designed to reduce...

The wind turbines are complex power production systems, and the blades are in a state of rotation under wind, which is different from building structures in the civil engineering industry. In this study, the blade in a 3-blade horizontal-axis wind turbine condensed as an Euler-Bernoulli beam, is considered as a cantilever shell structure installed on the hub.

With the development of megawatts wind turbines, excessive vibrations of the flexible and slender wind turbine tower under wind excitation have become increasingly ...