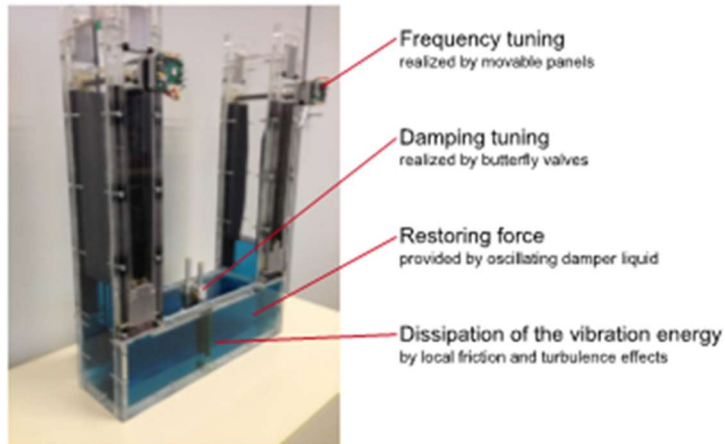


RWTH Technology

Liquid column damping system



Challenge

Wind turbines count as one of the most important techniques of renewable energy production and have a constantly increasing market share within the electric power sector. However, a further growth depends mainly on the technological developments considering structural properties. Wind turbines are slender structures with low inherent damping. Therefore, the designers have to consider potential structural vibrations, which can be easily induced by wind, wave and earthquake. The performance of a wind turbine depends on its tower height and rotor diameter. However, tall wind turbines with large rotors suffer from severe adverse vibrations, which cause fatigue problems. Power production efficiency can be increased in offshore sector by utilizing more floating wind turbines, which can operate in deep-sea regions. However, this involves strong wave loads, which in turn jeopardize the structural safety and impede the maintenance of the plants.

Solution

To reduce the wind, wave and earthquake induced tower and platform vibrations of onshore and offshore wind turbines a semi-active tuned liquid column damping (S-TLCD) system is proposed. The S-TLCD consists of a U-shaped tube, which is partially filled with a Newtonian fluid, such as water. The oscillating liquid mass evokes restoring forces in opposite direction of the structural vibration. Furthermore, local friction and turbulence effects in the tube dissipate the oscillation energy, allowing an efficient control of the structural vibrations.

Advantages

- Tuning of its dynamic properties in real-time to the changing structural, environmental and loading conditions
- Allows robust performance, superior to other vibration mitigation devices

Status

- Granted patent in USA and in China. Pending patent application at the German Patent and Trade Mark Office.
- Proof of concept accomplished by laboratory studies; Technology readiness level (TRL) 3
- Further development can be realized in the framework of a VIP+ project funded by German Federal Ministry of Education and Research (2018-2022)

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Fields of application

Renewable energy
(onshore and offshore
wind turbines)

Keywords

#Vibration control,
#wind, #wave, #earthquake,
#tower vibrations,
#platform vibrations

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- Application for a follow-up project was filed, combined with an additional patent application ("BB-TLCD" – #2474)
- Spin-off is planned by the Inventor