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Optimum Parameter Design of Annular Cylindrical Sloshing Damper for Attitude Control of Spar-Type Floating Offshore Wind Turbines

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The dynamic stability of the floating-type offshore wind turbine is affected by irregular wave, and the motion of floating substructure can also impose additional dynamic loads on the wind turbine tower. The method that can minimize the dynamic motion of floating substructure is needed. A tuned liquid damper (TLD), as a passive damper, is widely used to reduce the seismic-induced structural motion of high-rise buildings, but its significant drawback is sensitive to the excitation direction. In this regard, a direction-insensitive sloshing damper which could be applied to floating-type offshore wind turbine subject to multi-directional irregular wave is desired. An annular cylindrical sloshing damper is expected to be a candidate for reducing the dynamic motion of the floating-type offshore wind turbine. This paper deals with the experimental study on the characteristics of annular cylindrical sloshing damper and its optimum design of key parameters such as the water fill height. Based upon the experimental study on the frequency response of the spar-type floating substructure, the optimum parameters associated with the frequency response of such a floating structure are to be determined.

To confirm the effect above mentioned we made a structure, its foundation natural frequency is 1[Hz], and attached the annular type TLD on the top of the structure. The TLD characteristic is determined by mathematical model and it is compared with experimental model by uni-axial shaking table test. Through tuned the 1st resonance of TLD by changing the level of water, the distance between an inner-diameter and an outer-diameter, we observe the response magnitude of the structure in 1st resonance.