Analysis of Dynamics in Deep Water Catenary Model With One Buoy for SPM Systems in Floating Offshore Wind Turbine

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ABSTRACT
Floating wind turbines have the potential to be placed anywhere in the ocean from 60 meters to upwards of 900 m or beyond. This is a great benefit, because floating platforms allow offshore wind penetration into places where it may be prohibitive for fixed bottom offshore turbines. Floating platforms are also much less dependent on seabed conditions than fixed bottom structures because they do not rely on the ocean floor for support, with mooring line anchors being a notable exception. Mooring system plays a significant part in station keeping of floating offshore wind turbine. In this paper method of solution proposed for dynamic analysis in the frequency domain considering the loads on the mooring configuration through the spectral approach. System tension response and variation of tension in the mooring line at various depths have been evaluated for deepwater moorings having two different damping ratios equal to 0.1 and 0.3. Tension response spectra of deepwater mooring system for two damping ratios considered.

KEY WORDS: Mooring System; Floating Wind Turbine; Dynamic Method; Deep Water.

INTRODUCTION
It is known that oil and gas reservoirs will run empty in the future. Still the world is in growth and demands more energy than ever. In a time of environmental change and where the planet’s health is in focus we see a growing demand for clean energy. Floating wind turbines can be the most practical and economical way to extract the vast offshore wind energy resources at deep and intermediate water depths. Nonrenewable resources such as coal, natural gas, oil, and nuclear power are the primary sources of energy for many parts of the world. Burning fossil fuels, however, is harmful to the environment, and fossil fuel supplies are limited and subject to price volatility. And the safe storage and disposal of radioactive waste, the potential for radioactive contamination from accidents or sabotage, and the threat of nuclear proliferation are serious challenges to the success of nuclear power.

Renewable resources such as wind possess great potential because they are indigenous, nonpolluting, and inexhaustible. Much of the offshore wind resource potential in the United States, China, Japan, Norway, and many other countries is available in water deeper than 30m. In contrast, all the European offshore wind turbines installed to date are on fixed-bottom substructures.

These turbines have mostly been installed in water shallower than 20 m by driving monopiles into the seabed or by relying on conventional concrete gravity bases. These technologies are not economically feasible in deeper water. At some depth, however, floating support platforms will be the most economical. This natural progression is illustrated in Figure 1.

Fig. 1 Depth ranges for proposed and existing offshore wind turbine foundation designs.

A huge number of new offshore expansion is occurring in deep water remote positions using floating manufacture systems. The need to include dynamic deliberations in a rational design process for deep water mooring submissions has been addressed in numerous journals. Divesting system using SPM (Single Point Mooring) buoy and export lines is the basic solution for most of deepwater fields developments.