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Coupled wind and wave load analyses of multi-span suspension bridge supported by floating foundations

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Abstract

The TLP suspension bridge concept is a novel design proposed for crossing the wide and deep fjords along the E39 highway on the west coast of Norway. The bridge concept consists of a multi-span suspension bridge supported by one or more tension leg platforms. An accurate and representative load formulation for wind and wave excitation is essential for design of these structures. This article presents time domain analysis of a TLP suspension bridge subject to wind and wave loading. Analyses are performed for both coupled and separate wind and wave loading, in order to investigate possible coupling effects between the two environmental loads. A fully coupled nonlinear Newmark time integration scheme is used, where structural geometric nonlinearities, frequency-dependent hydrodynamic radiation properties and wind interaction are included. New developed tools are suitable for parallel calculation of the step time integration. Presented study shows a search strategy on coupled effect for different structural components.

Keywords: Multi-span suspension bridge; time domain analysis; coupled wind and wave analyses; wind interaction; hydrodynamics; parallel calculation.

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