Tools for Random Fatigue Analysis in Offshore Systems

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ABSTRACT

One key area during the development of any project of engineering is the behavior prediction of the system, essential for the technological solutions, in order to optimize the experimental resources and the time allowable to test various solutions still in the design phase.

Mechanical systems to be analyzed in this work are complex by nature. Once characterized the system, it is necessary to construct a numerical model to represent an idealization of it, and choose the most convenient technique to represent the random excitation of the system, issues that constantly require further research.

This work aims to apply computational methods for stochastic fatigue analysis of mechanical structures, such as offshore structures under cyclic loads of movement because of the incidence of random waves.

From the definition of the geometry and mass distribution on a floating unit, the boundary element method is applied to evaluate the resulting harmonic displacements in the relevant wave frequencies. The acceleration spectrum is applied as excitation in the structural analysis of a topside component above the floating structure, and the spectrum of stresses in the structure is used for estimating the fatigue life.

The methodology presented allows the evaluation of fatigue stresses in offshore structures such as Floating Production Storage and Offloading (FPSO) and floating wind generators.

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