A reformulated chance constraint optimization problem for the fatigue design of an offshore wind turbine mooring system

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Abstract

We consider a time-dependent reliability-based design optimization (RBDO) problem with constraints involving the maximum and the integral of a random process over a time interval. We focus especially on problems where the process is a stationary or a piece-wise stationary Gaussian process. A two-step procedure is proposed to solve effciently the problem. First, we use limit theorems to reformulate the original constraints into time-independent ones. We obtain an equivalent RBDO problem for which classical algorithms perform poorly. The second step of the procedure is to solve the reformulated problem with a new method based on an adaptive kriging strategy well suited to the reformulated constraints called AK-ECO for Adaptive Kriging for Expectation Constraints Optimization. The full procedure is validated on an example based on a harmonic oscillator and first results obtained on an offshore wind turbine mooring system industrial problem.

Keywords: RBDO, time, dependent reliability, failure probability, extreme value theory, adap, tive kriging, active learning, Monte, Carlo

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