Position Mooring Control Based on a Structural Reliability Criterion

To prevent failure of mooring lines in modern position mooring (PM) systems, position moored vessels are kept within a small distance from a desired reference position. A safe position within such region is where stress in all mooring lines are kept well below tensile strength. To prevent several mooring lines simultaneously from exceeding a stress threshold, this paper suggests a new algorithm to determine the reference position and an associated control system. The safety of each line is assessed through a structural reliability index. A reference position where all mooring lines are safe is achieved using structural reliability indices in a cost function, where both the mean mooring-line tension and dynamic effects are considered. An optimal set-point is automatically produced without need for manual interaction. The parameters of the extreme value distribution are calculated on-line thereby adapting the set-point calculations to the prevailing environment. In contrast to earlier approaches, several mooring line are simultaneously accounted for by the algorithm, not only the most critical one. Detailed simulations illustrate the features of the new method and it is shown that the structural reliability criterion based algorithm ensures the safety of mooring lines in a variety of external environmental conditions and also in situations of failure of a single line.

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