

عنوان مقاله:

Examining different methods based on reliability index and modelsimulation in estimating the failure probability of expensive structures

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خلاصه مقاله:

Reliability evaluation of structural problems with linear boundary condition functions is usually done at a low level and by first-order methods due to simple concepts and the need for a few calculations. These methods are suitable for providing an estimate of the safety level of the structure, and especially when the function expressing the performance of the structure is linear, they are accurate in providing the final answer. But when the said function is non-linear, due to inherent problems in this method, they cannot accurately estimate the structure's safety level. For such problems, it is necessary to use accurate methods of estimating the probability of failure, such as simulation methods. One of the most widely used simulation methods is the Monte Carlo method, which provides a correct answer to the probability of structural failure without any restrictions on the function form and dimensions of the problem. But this method also requires a high level of calculations for problems with low a probability of failure, which practically makes it difficult to use in practical engineering problems. The problem of choosing a suitable method between the two groups of simulation methods and methods based on the reliability index becomes more apparent when it is supposed to be combined with an optimizing algorithm for the optimal design of structures based on its reliability. Using the concepts in the first and second-order methods of reliability along with an optimization algorithm will reduce the volume of calculations. But this factor causes assumptions and simplifications, derivation of functions, and reliability sensitivity estimation to be a part of the structure design process. Therefore, the current research focuses on the performance of these methods in dealing with various structural problems, and the strengths and weaknesses of each method are evaluated in the process of analyzing benchmark problems with explicit and implicit limit functions. Ten different examples in this study were evaluated by seven methods. The two weighted WSM and SS subset simulation methods have also included many advantages and high accuracy with very low standard deviation.

کلمات کلیدی:

.possibility of failure; reliability; simulation; Monte Carlo. possibility of failure; reliability; simulation; Monte Carlo

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