Abstract

The proper estimation of the probability of failure along with the low computation volume is a major concern in the reliability of the structures. The Monte Carlo simulation method can simply provide an accurate estimate of the probability of failure, but for complex engineering problems with a low downtime probability and may provide an inefficiency estimate of the probability of failure. In this study, based on two weighted methods, the efficiency of the Monte Carlo simulation method has been improved. Based on the exponential function, the weight of the samples in the first method was randomized and in the second method, based on the point with the highest likelihood of occurrence of the failure (the best point) in the design space, and the adjusted data has been used to improve the Monte Carlo method. The convergence function of the proposed Monte-Carlo simulation methods, such as the accuracy and amount of performance estimation, has been compared with the use of several nonlinear mathematical and structural models with normal and non-normal random variables using the Monte Carlo simulation method. The results indicate that the proposed methods have estimated the correct results and significantly reduced the computational volume compared to the Monte Carlo method. Therefore, these methods can easily be used in reliability analysis of structures, optimization of reliability as well as their combination with new methods of metamodels, artificial neural network and Kriging method.

Key words: Monte Carlo simulation, failure probability, reliability analysis

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