Validation of Robust Design with The k-th Order Statistics by Structural Reliability Index

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Abstract

In the practical design process, uncertainty in the parameters should be appropriately taken into account. Robust design method is known as an effective design method under such uncertainties, where a design is found to be insensitive to use-conditions and other uncontrollable factors.

As a robust design method, we have proposed a worst-case design of structures based on a random sampling approach, where constraints are assigned on the worst values of the structural responses. We could successfully apply the approach to seismic design problems linking with a prescribed accuracy. Key concept of the method is estimation of the worst value by Random Search (RS) with the k-th order of the function values.

This formulation is known as distribution free tolerance intervals. On the one hand, reliability based design is another most popular design method under uncertainty. We consider the relationship between the two design methods under uncertainty. In particular, our interest focuses on tolerance intervals and structural reliability index.

Through a numerical example, we show the decision of the k of order statistics is closely related to the reliability index even if under a same tolerance interval. The result indicates a new aspect of the proposed method.