

Topology optimization of structures with interval random parameters

Ning Chen, Dejie Yu , Baizhan Xia, Jian Liu

State Key Laboratory of Advanced Design and Manufacturing for Vehicle Body,
Hunan University, Changsha, Hunan, People's Republic of China

Abstract

Due to there may be insufficient information to construct the precise probability distribution, an interval random model is employed to model the uncertain parameters of structure, such as the structural material and/or structure geometry. In the interval random model, the probability variables are used to treat the uncertain parameters, whereas some distribution parameters of probability variables are expressed as interval variables instead of precise value. The aim of this paper is to present a topology optimization methodology for structures with interval random parameters. The methodology combines deterministic topology optimization techniques with a hybrid perturbation method for the quantification of the behavior of the uncertain structure. The exploit of the hybrid perturbation method transforms the problem of topology optimization with interval random parameters to an augmented deterministic topology optimization problem. This leads to significant computational savings when compared with Monte Carlo-based optimization algorithms which involve multiple formations and inversions of the global stiffness matrix. The numerical example of linear flexible structure is presented to demonstrate the effectiveness of the proposed method.