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## Reliability-based topology optimization for structures using fuzzy set model

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### Abstract

The conventional topology optimization considering uncertainties is based on the probabilistic model. This paper proposes a new reliability-based topology optimization (RBTO) approach for the uncertain structural design based on the fuzzy set model, which can be constructed by expert opinions. The formulation of the proposed RBTO is established as a volume minimization problem under constraints established within the possibility context, termed as failure possibility constraints. The computation for the failure possibility constraints in each optimization loop is a double-loop nested problem. Accordingly, the proposed RBTO is a triple-loop nested problem, which is computationally expensive. To improve the computational efficiency, the target performance approach is introduced to the failure possibility constraints, and thus the triple-loop nested problem is reduced to a double-loop nested problem. To further improve the computational efficiency, the interval perturbation method (IPM) is used to estimate the constraints, thereby the calculation for the constraints in each optimization loop becomes deterministic, and the double-loop nested problem is reduced to an approximate single-loop problem. Numerical results on two examples are presented to verify the effectiveness and

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