11th World Congress on Structural and Multidisciplinary Optimisation
07th -12th, June 2015, Sydney Australia

Robust Topology Optimization of Thin Plate Structure under Concentrated Load with Uncertain Load Point

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Abstract

This study investigates the robust topology optimization of the thin plate under concentrated load with uncertain load point. This study extends the deterministic topology optimization for the thin plate structure [1] considering uncertainty. Several researches investigated the effect of uncertain load direction, load magnitude or load distribution on the topology optimization e.g., [2]. However, the robust topology optimization considering uncertainty of the load point has not been studied yet.

In this study, the load point uncertainty is modelled through the convex hull model [3]. The nominal concentrated load in out-of-plane direction is applied at the center of the plate modelled based on Reissner-Mindlin plate theory. The load point uncertainty is limited in a circle centered at the nominal load point. The worst load condition is defined as the applied load at the worst point in the convex hull that gives the worst value of the mean compliance. The worst point is easily obtained from the convex hull approach. Then, the robust objective function is formulated as a weighted sum of the mean compliance obtained from the mean load condition and the worst compliance obtained from the worst load condition. This robust topology optimization is constructed using the level set-based topology optimization method [4].

Through numerical examples, the robust optimum configuration is compared with the deterministic optimum configuration. Then, validity of the proposed robust design method is discussed.

References

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