

عنوان مقاله:

3D BENCHMARK RESULTS FOR ROBUST STRUCTURAL OPTIMIZATION UNDER UNCERTAINTY IN LOADING DIRECTIONS

محل انتشار:

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خلاصه مقاله:

This study has been inspired by the paper "An efficient 3D topology optimization code written in MATLAB" written by Liu and Tovar (۲۰۱۴) demonstrating that SIMP-based three-dimensional (3D) topology optimization of continuum structures can be implemented in ۱۶۹ lines of MATLAB code. Based on the above paper, we show here that, by simple and easy-to-understand modifications we get a few lines longer code, which is able to solve robust topology optimization problems with uncertain load directions. In the presented worst load direction oriented approach, the varying load directions are handled by quadratic constraints, which describe spherical regions about the nominal loads. The result of the optimization is a robust compliance-minimal volume constrained design, which is invariant to the investigated directional uncertainty. The key element of the robustification is a worstload-direction searching process, which is formulated as a small quadratic programming problem with quadratic constraints. The presented approach is a 3D extension of the robust approach originally developed by Csébfalvi (۲۰۱۴) for 2D continuum structures. In order to demonstrate the viability and efficiency of the extension, we present the model and algorithm with detailed benchmark results for robust topology optimization of 3D continuum structures. It will be demonstrated that the computational cost of the robustification is comparable with its deterministic equivalent because its central element is a standard 3D deterministic multi-load structure optimization problem and the worst-load direction searching process is formulated as a significantly smaller quadratically constrained quadratic programming problem, which can be solved efficiently by several different ways.

کلمات کلیدی:

optimal topology design, robust topology optimization, uncertain design parameters, uncertain load direction, worst load direction

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