Optimal truss and frame design from projected homogenization-based topology optimization

In this article, we propose a novel method to obtain a near-optimal frame structure, based on the solution of a homogenization-based topology optimization model. The presented approach exploits the equivalence between Michell's problem of least-weight trusses and a compliance minimization problem using optimal rank-2 laminates in the low volume fraction limit. In a fully automated procedure, a discrete structure is extracted from the homogenization-based continuum model. This near-optimal structure is post-optimized as a frame, where the bending stiffness is continuously decreased, to allow for a final design that resembles a truss structure. Numerical experiments show excellent behavior of the method, where the final designs are close to analytical optima, and obtained in less than 10 minutes, for various levels of detail, on a standard PC.

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