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Stress-constrained approach for optimal design of structural topology

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1. Introduction

In recent years, a lot of attention has been devoted to compliance-based topology optimization [1] and as a result of this many approaches have been proposed such as *Solid Isotropic Material with Penalization* (SIMP), *Bidirectional Evolutionary Structural Optimization* (BESO) or *Level sets*, to mention a few. However, such approaches are not suitable for stress-constrained topology optimization which require specialized procedures to aggregate stress within certain neighborhood (so-called *p*-norm approach) [2-3].

The aim of the paper is a practical engineering formulation of the topology optimization for structures made of elastoplastic material. This paper provides a comprehensive approach to optimizing the topology of elastoplastic structures, including both the problem statement and its efficient computer implementation. Instead of the traditional compliance minimization approach, the aim of this work is to find a structure with the minimum mass that can carry on a given load, provided that the corresponding stresses do not exceed an acceptable limit. The general formulation of the problem is based on the classical approach allowing to determine the yield strength of the designed structure [4]. The proposed method finds the optimal structure in an iterative way, using only the stress intensity distribution and does not require the user to explicitly know sensitivity.

The effectiveness of the proposed methodology is illustrated by some representative examples, including cantilever beams and L-shape structure. Finally, some extensions of the method for reliability-based design will be discussed [5].

2. References

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