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Structural Topology Optimization Considering Buckling Constraints

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Abstract

Structural strength, stiffness, and stability are three of the most important factors which should be considered for assessing structural designs. Therefore, in order to achieve safe and practical designs, structural stability must be taken into account during a structural optimization procedure. Buckling optimization has drawn more research attention in recent years.

Some issues in the topology optimization of continuum structures considering structural stability are investigated. The optimization problem of compliance minimization under constraints on material volume and buckling load factors is considered. The Solid Isotropic Material with Penalization (SIMP) material model is used for topology optimization and a hybrid stress element is employed in structural analysis.

An adaptive continuation method is proposed, in which the penalty parameter in the SIMP model is automatically adjusted during the optimization procedure according developed rules. Using these rules, buckling constraints would be properly considered throughout the optimization to guide optimized designs to move in more appropriate directions.

Numerical examples will be presented to demonstrate the effectiveness of the proposed method and future applications of the method discussed.