



结构畸变比能处理的应力约束全局化的连续体结构拓扑优化

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CONTINUUM STRUCTURAL TOPOLOGY OPTIMIZATION WITH GLOBALIZED STRESS CONSTRAINT TREATED BY STRUCTURAL DISTORTIONAL STRAIN ENERGY DENSITY

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- [摘要](#)
- [图/表](#)
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摘要 该文根据von Mises强度准则的畸变比能本质, 计算单元畸变比能替代应力约束; 依照应力全局化策略, 定义结构畸变比能约束概念, 求解应力约束下重量最小的连续体结构拓扑优化问题, 急剧地减少了应力约束。构造许用应力和结构最大应力的比值含参数幂函数, 对约束限进行动态修正。基于ICM(Independent Continuous and Mapping, 独立、连续、映射)方法, 采用指数型快滤函数建立了结构在畸变比能约束下的结构拓扑优化模型, 并选取精确映射下的序列二次规划进行求解。数值算例表明: 采用修正的结构畸变比能的应力全局化策略, 对于结构拓扑优化问题的求解是有用和高效的。该文提出的方法对解决工况间存在病态载荷的问题也是有益的。

关键词: [结构拓扑优化](#) [应力约束](#) [ICM方法](#) [结构畸变比能](#) [快滤函数](#)

Abstract: The stress constraint is replaced by the distortional strain energy density constraint because the von Mises strength criterion was essentially established on the distortional strain energy density. According to stress globalization strategy, the concept of a structural distortional strain energy density constraint is defined and it is applied to sharply reduce stress constraints in solving a structural topology optimization problem with least weight subjected to stress constraints. A parameter-power function about the ratio of allowable stress to maximum stress in the structure is constructed to modify the constraint limit dynamically. Based on ICM (Independent Continuous and Mapping) method, an exponential-class fast filter function is adopted to present a structural topological optimization model, and then the model is solved by sequential quadratic optimization based on exact dual mapping. The numerical examples demonstrate that the approach of adopting globalization strategy of modified structural distortional strain energy density to deal with the structural topological optimization problem with stress constraints is available and efficient. The method proposed in the paper is also useful to solve the loading illness problem between different loading cases.

Key words: [structural topology optimization](#) [stress constraint](#) [ICM method](#) [structural distortional strain energy density](#) [fast filter function](#)

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