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多功能结构拓扑形态优化数值方法

Structural topology optimization with multiple functions

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英文关键词: [structural morphogenesis](#) [shape optimization](#) [topology optimization](#) [extended ESO method](#)

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中文摘要:

对建筑结构设计的多功能要求,以平面问题为研究对象,对改进进化论方法进行了功能上的改进,增强了方法对复杂空间条件的适应性,提高了计算效率和所生成结构体的质量.针对建筑对空间的限制,将方法的允许空间拓展为自由边界允许空间,并引进临时允许空间的概念;针对结构功能需求,研究了能够适应支座改变、荷载组合等多工况情况的合理结构形态创构方法;考虑到材料的受力特性,研究了相应(如指定构件纯受压或纯受拉)的结构拓扑形态优化方法.文中还通过算例分析了方法的特点,探讨了方法所得结构形态的一些力学特性.该方法所得结构为以均匀拉压应力形式来抵抗荷载,其形式可为结构概念设计提供参考.

英文摘要:

In this paper, extended evolutionary structural optimization (Extended-ESO) method was improved in functions for meeting the requirements of architectural and structural design, increasing its applicability for complex space requirements, and enhancing its calculation efficiency and quality of the new structure. Considering the space limitation of the architecture function, the allowable space of this method was extended to free boundary allowable space and the concept of temporary allowable space was introduced in plane problem. In order to meet the need of structural function, a new method was introduced for creating rational structures with multiple load cases and constraints. Further considering material mechanical properties, tension-only and compress-only structures were studied by extended ESO method. Otherwise, the features of the method were analyzed through several examples and some mechanical properties of the structures derived from the method were discussed. The structure form derived from this method was mainly in a state of uniform tension and compression stress, can reflect the reasonable force transmission and provide some references for concept design.

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