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三杆类桁架材料模型多工况最小柔度优化

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OPTIMIZATION OF MINIMIZING COMPLIANCE UNDER MULTIPLE LOAD CASES BY THREE MEMBERS TRUSS LIKE MATERIAL MODEL

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摘要 研究了多工况结构柔度最小化方法。提出了3杆类桁架连续体材料模型。推导了该材料的刚度矩阵及其导数。通过优化杆件分布场得到优化的类桁架连续体。克服了目前普遍采用单元的“有”和“无”表示结构拓扑的轮廓粗糙、锯齿状边界问题。结点位置的杆件密度和方向作为设计变量，杆件在单元内的密度和方向通过结点位置的数值插值得到，并且在单元内连续变化。由于没有抑制中间密度，完全不存在数值不稳定问题。类桁架连续体由于与杆系结构有明确的对应关系，可以合理地转化杆系结构。选择杆件分布场中的部分杆件可以形成杆系结构。如果再进一步作尺寸和形状优化就可以得到最终的拓扑优化结构。

关键词： 结构优化 拓扑优化 类桁架连续体 柔度 多工况

Abstract： A method to minimize the compliance of structures under multiple load cases is studied. A three member truss-like material model is presented. The stiffness matrix and its sensitivities are derived. The member distributed field is optimized to form a truss-like continuum. In most topology optimization method, structural topology is expressed by ‘existence’ and ‘nonexistence’ of elements. Rough outlines with zigzag lines are not avoided. This problem is overcome thoroughly. The member densities and orientations at the nodes are taken as design variables. The member densities and orientations at any point in an element vary continuously. For intermediate densities being not suppressed, no numerical instabilities exists at all. Since there is an explicit relation between a truss-like continuum and a member structure, it is easy to transfer a truss-like continuum to a member structure rationally. Parts of members in the truss-like continuum, which are formed according to the member distribution, are chosen to form the nearly optimal member structure. Furthermore if the positions of the nodes and the cross sectional areas of the members are optimized, the final topological optimal structures are established.

Key words： structural optimization topology optimization truss-like continuum compliance multiple load cases

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[1] 杜剑明;张维声;郭旭. 基于SAND列式的桁架结构优化问题序列线性规划算法[J]. , 2012, 29(3): 21-26.

[2] 冷国俊;仇原鹰;保宏. 基于交叉过滤的刚架结构拓扑优化[J]. , 2012, 29(2): 69-73,8.

[3] 宋郁民;吴定俊. 改进的基于弹性核法的曲梁有限梁段法[J]. , 2011, 28(增刊I): 16-021.

[4] 欧笛声;周雄新. 含自重载荷作用下桁架拓扑优化的功射极法[J]. , 2011, 28(7): 136-142,.

[5] 刘庆玲. 柔性对称微位移放大机构的分析与仿真[J]. , 2011, 28(6): 231-235.

[6] 杨 洋;童根树. 水平弹性支承圆弧钢拱的弹性屈曲分析[J]. , 2011, 28(3): 9-016.

[7] 李东泽;于登云;马兴瑞. 基频约束下的桁架结构半定规划法拓扑优化[J]. , 2011, 28(2): 181-185.

[8] 张军;刘建勋;徐进;李伟;穆荣. 结构损伤诊断的模态柔度差曲率法[J]. , 2011, 28(12): 112-118.

[9] 宣东海;隋允康;铁 军;叶红玲. 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[J]. , 2011, 28(10): 1-008.

[10] 谢 凡;沈蒲生;王海波. 柔度法考虑钢筋混凝土梁柱单元变形局部化的计算方法[J]. , 2011, 28(10): 118-123.

[11] 周凌远;李 乔. 钢筋混凝土梁非线性有限元分析方法[J]. , 2011, 28(1): 82-086.

[12] 隋允康;铁 军. 结构拓扑优化ICM显式化与抛物型凝聚函数对于应力约束的集成化[J]. , 2010, 27(增刊Ⅱ): 124-134.