

世博会工程专辑

世博轴阳光谷钢结构稳定性分析

赵阳¹, 田伟¹, 苏亮¹, 邢栋¹, 周运朱¹, 董石麟¹, 张伟育², 方卫², 张安安³

1. 浙江大学 空间结构研究中心, 浙江杭州 310058; 2. 华东建筑设计研究院有限公司, 上海 200002; 3. 上海世博土地控股有限公司, 上海 200125

摘要:

世博轴阳光谷单层空间网格结构曲面形状复杂、几何尺度大、悬挑跨度大, 其整体稳定性是结构分析与设计中的关键问题之一。分析以特征值屈曲模态作为初始几何缺陷分布形式的合理性, 通过非线性有限元分析系统考察了阳光谷单层网格结构的整体稳定性能, 并研究了单根杆件失稳对结构整体极限承载力的影响。分析结果表明: 几何非线性以及几何、材料双重非线性临界屈曲承载力均满足相关规范要求, 阳光谷钢结构具有良好的整体稳定性; 阳光谷钢结构对几何初始缺陷不敏感, 阳光谷上由索膜结构传来的索拉力可进一步降低其缺陷敏感性; 局部杆件的失稳退出工作并不会导致结构整体承载力的突然丧失, 整体结构具有良好的承载能力。 图7表6参7

关键词: 单层空间网格结构 初始缺陷 非线性有限元分析 杆件失稳 整体稳定

Stability analysis of Sun Valley steel structure for the Expo Axis project.

CHEN Min¹, XING Dong¹, ZHAO Yang¹, SU Liang¹, DONG Shilin¹, WANG Dasui², FANG Wei², ZHANG Anan³

1.Space Structures Research Center, Zhejiang University, Hangzhou 310058, China; 2.East China Architectural Design & Research Institute Co. Ltd, Shanghai 200002, China; 3.Shanghai World Expo Land Holding Co. Ltd, Shanghai 200125, China

Abstract:

The single-layer lattice structures of the Sun Valleys for Expo Axis project have complicated curved surface with huge dimensional size and large cantilever span, so overall stability is one of key problems in structural analysis and design. The rationality for introducing the eigenvalue buckling mode as the distribution pattern of initial geometric imperfection was discussed, and the overall stability behavior of the single-layer lattice structure was then investigated through nonlinear finite element analysis. The effect of single member buckling on structural ultimate load-bearing capacity was also examined. It is shown that, the critical buckling loads from both geometrically nonlinear analysis and geometrically and materially nonlinear analysis meet the requirement of relevant codes, so the Sun Valley steel structures have good overall stability bearing capacity. The Sun Valley steel structures are not sensitive to initial geometric imperfections in general, and the tensile forces from cable-membrane structure further reduce the imperfection sensitivity. Removal of local members due to buckling will not lead to a sudden loss of overall bearing capacity, indicating that the structure has a good load-bearing behavior.

Keywords: single-layer lattice structure initial imperfection non-linear FEA member buckling overall stability

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通讯作者:

作者简介:

作者Email: ceyzhao@zju.edu.cn

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