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学术论文

深圳大运会体育中心体育场整体模型承载力试验研究

郭彦林;窦超;王永海;曹平周;刘琼祥;倪绍文;郭满良;叶虔;李兴武;

清华大学土木工程系;河海大学土木工程学院;深圳市建筑设计研究总院;深圳市建筑工务署;

摘要: 深圳世界大学生运动会体育中心体育场屋盖钢结构采用"单层折面空间网格"结构体系。本文通过建立"预堆载的自平衡加载体系",采用"手动葫芦分级分组张拉"、"位移初控-内力微调"的加载方案完成了体育场大比例整体模型承载力试验,研究了模型刚度变化过程及最终承载力,观察其薄弱部位及对应破坏模式,并采用有限元方法对结果进行了分析和评价。研究结果表明,考虑几何非线性、材料非线性的有限元分析与模型试验结果吻合较好;单层折面空间网格结构具有足够的刚度和安全储备,但由于结构自身特点,其承载力往往受个别高拉应力构件强度所控制;承受较大拉弯作用的构件与肩峰节点的连接部位易发生局部破坏,成为整体结构的薄弱环节,这些部位在设计中要留有足够的富裕度,施工中严格控制焊接缺陷,保证其具有足够的塑性变形能力。

关键词: 单层折面空间网格结构 整体模型试验 自平衡加载体系 分级分组张拉 极限承载力

Experimental investigation of integral scaled model on load-carrying capacity of main stadium of Shenzhen Universiade Sport Center

GUO Yanlin1,DOU Chao1,WANG Yonghai1,CAO Pingzhou2,LIU Qiongxiang3,NI Shaowen4, GUO Manliang3,YE Qian4,LI Xingwu4(1.Department of Civil Engineering,Tsinghua University,Beijing 100084,China;2.College of Civil Engineering,Hohai University,Nanjing 210098,China;3.Shenzhen General Institute of Architectural Design & Research,Shenzhen 518031,China;4.Bureau of Public Works of Shenzhen Municipality,Shenzhen 518031,China)

Abstract: A new type of structural system named as 'single-layer folded-plane spatial reticulated structure' was adopted in the steel roof of main stadium in Shenzhen Universiade Sport Center.An experimental investigation of integral structural scaled model was carried out.The loading with a 'pre-stacked self-balancing loading system' and the scheme of 'stretching in batch and grade using manual chain hoists','controlling by displacement firstly-then adjusting by inner force',was conducted to study the stiffness variation and load-carrying capacity of the model.The weak regions and failure mechanism were observed and investigated accordingly.Test results agree with analytical results by FEM,indicating that single-layer folded-plane spatial reticulated structure has enough integral stiffness and safety factor,however the load-carrying capacity is determined by individual members in high tension stress.The connection of members under high tension force and bending moment with joints in shoulder apex is the weak region of the whole structure,therefore the regions should be much concerned and the welding quality should be controlled strictly during construction.

Keywords: integral scaled model test self-balancing loading system stretching in grade and batch load-carrying capacity

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作者Email:

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