本期目录 | 下期目录 | 过刊浏览 | 高级检索

[打印本页] [关闭]

学术论文

内凹式索拱结构极限承载力研究

黄利锋: 冯健: 赵建: 蔡建国: 盛平: 甄伟: 陈强: 沈婷:

东南大学混凝土及预应力混凝土结构教育部重点实验室;江苏省预应力工程技术研究中心;北京市建筑设计研究院;中铁第四勘察设计院集团有限公司;

摘要: 采用考虑双重非线性的有限元方法对内凹式索拱结构的极限承载力进行了参数研究。主要分析了5种荷载形式下支座形式、拱矢跨比、索矢跨比、撑杆数量、拱截面、索截面、初始张拉力和初始缺陷等参数对内凹式索拱结构承载力的影响;并与仅考虑几何非线性的结果进行了对比。分析结果表明:支座形式、矢跨比、撑杆数量、拱截面等因素对结构承载力影响较大;索截面、初始张拉力和初始缺陷等对结构承载力影响较小;其合理的取值范围为:拱矢跨比取0.125~0.20,索矢跨比取0.05~0.10,索截面积取拱截面积的4%~6%,与拱结构相比,该结构的整体稳定性、极限承载力、整体刚度都大幅度提高,对缺陷的敏感度减低;半跨荷载是结构设计的控制荷载,给出了快速确定初始张拉力的简化计算公式。

关键词: 内凹式索拱 双重非线性 初始缺陷 有限元分析 极限承载力

Ultimate loading capacity of inner concave cable arch structure

HUANG Lifeng1,2,FENG Jian1,2,ZHAO Jian1,2,CAI JianGuo1,2,SHENG Ping3,ZHEN Wei3,CHEN Qiang4,SHEN Ting4(1.Key Laboratory of Concrete and Prestressed Concrete Structures of China Ministry of Education,Southeast University,Nanjing 210096,China;2.Engineering Research Center for Prestress of Jiansu Province,Nanjing 210096,China;3.Beijing Institute of Architectural Design,Beijing 100045,China;4.China Railway Siyuan Survey and Design Group Co.Ltd,Wuhan 430063,China)

Abstract: The double nonlinear finite element method including geometry and material nonlinearity is used to analyze the ultimate loading capacity of inner concave cable arch structure. The influences of several factors such as the boundary conditions, the rise-to-span ratios of arch and cable, the number of struts, the cross section areas of arch and cable, the initial tensile force and the initial imperfection on the ultimate capacity were presented with considering five load cases. The results of double nonlinear analyses were compared with those of geometry nonlinear analyses. From the investigation, it is found that the loading capacity depends largely on the boundary conditions, the rise-to-span ratios, the number of struts and cross section of arch. It is also observed that the loading capacity depends little on the section area of cable and the initial tensile force. In addition, the rational ranges for the rise-to-span ratios of arch and cable are found to be 0.125-0.20, and 0.05-0.10, respectively, and the rational range for the cable section area is 4%-6% of that of the arch. Compared with conventional arch construction, the inner concave cable arch structure is less sensitive to initial imperfection and is highly improved in terms of global stability, ultimate loading capacity, overall rigidity with the half-span load as the control load. A formula for the determination of the initial tensile force is proposed.

Keywords: double nonlinearity ultimate loading capacity initial imperfection

收稿日期 2010-04-05 修回日期 2010-04-05 网络版发布日期 2010-04-05

DOI:

基金项目:

国家自然科学基金项目(50478075)

通讯作者:

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(0KB)
- ▶ [HTML全文]
- ▶参考文献[PDF]
- ▶参考文献

服务与反馈

- ▶ 把本文推荐给朋友
- ▶加入我的书架
- ▶加入引用管理器
- ▶引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶浏览反馈信息

本文关键词相关文章

- ▶ 内凹式索拱
- ▶ 双重非线性
- ▶初始缺陷
- ▶有限元分析
- ▶ 极限承载力

本文作者相关文章

- ▶黄利锋
- ▶冯健
- ▶赵建
- ▶ 蔡建国
- ▶盛平
- ▶甄伟
- ▶ 陈强 ▶ 沈婷

PubMed

- Article by

作者间介∶			
作者Email:			

参考文献:

本刊中的类似文章

1. 黄利锋1,2, 冯健1,2, 赵建1,2, 张晋1,2, 蔡建国1,2, 盛平3, 甄伟3,陈翠4.新广州站内凹式索拱结构模型静力试验研究[J]. 建筑结构学报, 2010,31(7): 110-117

Copyright by 建筑结构学报