



单层FRP编织网结构的基本力学模型与分析

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FUNDAMENTAL MECHANICAL MODEL AND ANALYSIS OF SINGLE LAYER FRP WOVEN WEB STRUCTURES

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摘要 FRP 大跨编织网结构是一种新型大跨空间结构体系,它由FRP 板条按一定规律编织并通过平面外整体张拉构成,具有很好的建筑效果。此结构体系为柔性构件构成的空间整体张拉结构,有4 个关键受力状态。该文研究圆形环梁、板条中心对称分布的典型的单层FRP 编织网结构,提出了编织网结构力学分析的基本假设和通用力学分析模型,对单层网面进行了平面外整体张拉、全跨荷载工况和半跨荷载工况的理论分析,推导了相应的计算公式,并进行了编织网结构的计算。通过研究建立的FRP 编织网结构的基本力学方程,可分析计算单层编织网的各个受力状态,为FRP 编织网结构的设计计算提供了理论工具。还进行了参数分析,得到了各参数对结构在使用过程中刚度的影响规律,为FRP 编织网结构的初步设计提供了参考。

关键词: FRP 编织网结构 大跨空间结构 整体张拉 几何刚度 几何非线性

Abstract: The fiber-reinforced polymer (FRP) woven web structure (WWS) is an innovative large-span spatial structure composed of FRP strips. The FRP strips are crossed each other and woven to form a flexible web plane, and then the web is stressed integrally in an outer plane. The WWS is a tensegrity spatial structure system made of flexible members of several mechanical statues. The basic assumptions, the fundamental mechanical model, and the equations of the simple FRP WWS of ring beams and central symmetry FRP strips are studied. The equations are drawn. Based on the equations, three load cases of FRP WWS including integrally pre-stressed in an outer plane, the whole span load and half span load are analyzed in theoretical method. The numerical calculations of a simplified FRP WWS are conducted. The fundamental mechanical model of FRP WWS is established, and the theoretical approach for analyzing FRP WWS is concluded. Those provide the theoretical method for calculating of FRP WWS. Through the parameter analysis, the influence principals of parameters on stiffness of structure in service state are studied, which can be referred for the preliminary design of FRP WWS.

Key words: FRP woven web structure large-span spatial structure integrally pre-stressed geometric stiffness geometric nonlinear

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