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钢管混凝土标准桁肋拱面外弹性稳定分析

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ANALYSIS OF OUT-OF-PLANE ELASTIC BUCKLING OF STANDARD CONCRETE FILLED STEEL TUBULAR TRUSS RIBS ARCH

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摘要

以面外失稳的主要影响因素作为构造参数,对已建的钢管混凝土桁拱进行统计分析,构建一虚拟拱,然后参照实际桥例,建立了既有典型意义、又符合工程实际的标准拱.以标准拱为对象,进行面外弹性稳定性的参数分析.结果表明:钢管混凝土桁拱面外稳定性随着拱桥宽跨比增加而增大;拱顶横撑形式对面外稳定性影响较小;其他横撑影响较大,其有利作用从大到小依次为X 型与米字型、K 型和一字型;拱肋间横撑的疏密程度(拱肋的自由长度)影响较大;桁拱的弹性稳定系数随着矢跨比*f*/*L* 的增大呈现先增大后较小的趋势,在*f*/*L*=0.2~0.25时达到峰值;面外长细比越大面外稳定性越差,面外长细比在80~140区间影响较大,在140~220区间影响减弱.最后,对应用特征值求解拱的面外弹性分支计算方法进行了讨论.结果表明:计算时应以拱所受压力最大的荷载工况,且该方法的计算结果不能有效反映几何初始缺陷和横向力对结构真实的面外失稳破坏的影响.

关键词: 钢管混凝土 桁肋拱 面外 弹性稳定 标准拱

Abstract:

Based on the statistical analysis of concrete filled steel tubular (CFST) truss arch bridges, considering the main structure parameters on its out-of-plane buckling, a virtual bridge is built and revised into a standard one by referring to two real bridges. The parameter analyses are conducted on this standard bridge by using the elastic buckling analysis method. The results show that the out-of-plane stability will be improved with the increase of the ratio of the width to span of the bridge and the decrease of the distances of the bracings; the X-shaped bracings have the largest improvement on the out-of-plane stability, followed by K-shaped and straight bracings; the stability becomes worse quickly with the increase of the out-of-plane slenderness from 80 to140, and then slowly from 140 to 220. Finally, the elastic buckling analysis method by solving the eigenvalue is discussed. Discussion results indicates that the load condition in the calculation should be the case causing the largest compression forces in the arch, and this method can not reflect initial geometric defects and the action of the transverse forces on it.

Key words: concrete filled steel tube (CFST) truss ribs arch out-of-plane elastics stability standard arch

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