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钢管初应力对钢管砼拱桥承载力影响非线性分析

Nonlinear analysis of steel tube initial stress effect in steel tube on bearing capacity for CFST arch bridges

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中文关键词: [钢管混凝土拱桥](#) [钢管初应力](#) [承载力影响系数](#) [实体-空间梁单元](#) [组合空间梁单元](#) [实用计算公式](#)

英文关键词: [CFST\(Concrete Filled Steel Tubular\) arch bridge](#) [initial stress steel tube](#) [Influence factor of bearing capacity](#) [solid-spatial beam element](#) [combined spatial beam element](#) [practical formulas](#)

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中文摘要:

基于非线性问题的平衡方程和空间梁单元非线性几何方程, 推导了一般线弹性关系下计入初应力影响的空间梁单元显式切线刚度矩阵. 针对钢管混凝土哑铃型截面的构造特点, 提出了组合空间梁单元法, 较好解决了哑铃型截面钢管初应力的计算与存储问题, 并给出了承载力分析时单元划分的具体方法, 编制了专用计算程序, 计算结果与试验吻合良好. 开展了不同钢管初应力系数、不同截面含钢率和不同跨径对钢管混凝土拱桥承载力的影响分析. 结果表明, 钢管初应力将使钢管混凝土拱桥的承载力降低, 降低幅度与拱肋截面型式有关, 承载力最大降低值可超过30%. 最后给出了三种考虑钢管初应力影响的常用拱肋截面型式拱桥承载力影响系数实用计算公式.

英文摘要:

Based on equilibrium equation of nonlinear problem and nonlinear geometric equation of spatial beam element, explicit formula of tangent stiffness matrix for spatial beam element was deduced, its constitutive relationship includes the initial stress and initial strain. According to structure character of dumbbell section, a combined spatial beam element is presented for computing and storing steel tube initial stress. Method of element division was described about bearing capacity analysis for concrete filled steel tubular (CFST) arch bridge. A special program was developed. The results calculated by program were in accordance with tests. A lot of bearing capacity calculation are performed, with regard to different coefficients of initial stress steel tube, different sectional steel ratios and different spans. Results show that initial stress of steel tube could reduce the capacity of CFST arch bridge, the reduction extent depends on the sectional type of arch rib, and the maximum reduction can exceed 30%. Finally, practical formulas of bearing capacity influence factor are given for the CFST arch bridge with three common sectional types.

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