

学术论文

平面KT型圆钢管搭接节点有限元参数分析与承载力计算

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摘要:

以平面KT型圆钢管搭接节点的试验数据为基础, 从节点破坏模式、变形过程和承载力等方面对节点的非线性有限元建模方法进行校验。研究揭示了贯通直腹杆受压搭接节点的破坏过程和塑性区扩展情况, 重点考察了贯通直腹杆受压且内隐蔽部分焊接的搭接节点几何参数和内隐蔽部分焊接与否对节点承载力的影响。有限元参数分析结果表明: 腹、弦杆直径比和弦杆径厚比的变化对搭接节点的承载力影响较大, 而腹、弦杆壁厚比和搭接率影响较小; 内隐蔽部分未焊接明显降低贯通直腹杆受压的搭接节点承载力; KT型圆钢管搭接节点承载力均大于相应的KT型和N型零间隙节点承载力。最后, 在N型零间隙节点承载力计算公式的基础上, 应用多元线性回归方法拟合出平面KT型圆钢管搭接节点的承载力计算式; 该计算式与试验结果吻合良好, 且具有较好的连续性和适用性。

关键词: 平面KT型圆钢管搭接节点 N型零间隙节点 有限元参数分析 承载力

Finite element parametric analysis and design equation of bearing capacity for unstiffened uniplanar overlapped CHS KT-joints

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Abstract:

A nonlinear finite element model simulating the behavior of unstiffened overlapped CHS KT-joints was generated and validated by comparing failure mode, deformation process and load carrying capacity with test results. This study revealed the failure process and propagation of plasticity of overlapped joint with vertical through brace in compression and hidden weld. In particular, the effects of geometric parameters and hidden weld on ultimate load carrying capacity of the joints were examined. The results of finite element parametric analysis indicate that diameter ratio of brace versus chord and half diameter to thickness ratio of the chord have significant effect on the maximum load carrying capacity of overlapped joints, while brace to chord thickness ratio and overlap ratio have little effect on the maximum load carrying capacity. The load carrying capacity of overlapped CHS KT-joints is greater than that of zero gap KT-joints and N-joints. The absence of hidden welds obviously reduces the load carrying capacity of the vertical through brace in compression overlapped CHS KT-joints. Finally, based on the design equation of zero gap N-joint, a formula predicting the load carrying capacity of overlapped CHS KT-joint with or without hidden weld was proposed using multivariate regression analysis. Results obtain using the proposed design equation agrees well with experimental results. With good consistency, the equation can be widely applied to different brace geometries.

Keywords: unstiffened uniplanar overlapped CHS KT-joint zero gap N-joint finite element analysis bearing capacity

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