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复式空心钢管混凝土组合轴压弹性模量分析

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ANALYSIS OF COMPRESSIVE ELASITIC MODULUS OF HOLLOW COMPOSITE CFST COLUMN

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摘要 将复式空心钢管混凝土柱分成混凝土、内钢管和外钢管三部分,作为拟平面轴对称问题进行分析。应用弹性力学中的势能驻值原理进行弹性理论分析,描述复式空心钢管混凝土柱在小变形下的弹性行为及套箍机理。导出了钢管混凝土柱在轴向压力作用下的套箍系数、组合轴压弹性模量的理论计算公式。分析结果表明:复式空心钢管混凝土的组合轴压弹性模量与钢管的泊松比、混凝土的泊松比有着必然的联系,同时钢管与混凝土之间的"套箍作用"对组合弹性模量也有一定的影响。组合轴压弹性模量随着含钢率的增大基本成线性增长,并得到了复式空心钢管混凝土柱在轴力作用下的应力分配比不是简单地按单轴弹性模量比分配的结论。

关键词: 复式空心钢管混凝土   套箍机理   势能驻值原理   组合弹性模量   泊松比

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Abstract: A hollow composite CFST (concrete-filled steel tube) is divided into three parts: a concrete core, an inner steel tube and an outer steel tube. As a pseudo planar problem, it was analyzed by an elastic axisymmetrical method. By means of the theorem of the stationary value of potential energy, the elasticity theory analysis of an infinitesimal deformation was performed for the hollow composite CFST column. The theoretical formulas of confinement coefficients, and the composite compressive elastic modulus were gained, and the formulas can actually and reliably describe the elasticity behaviors and the confinement mechanism of the composite column. Analytical results indicate that the composite axial elastic modulus is influenced by the Poisson's ratio not only of the concrete core but also of the steel tube, and it is also changed with the confinement force between the concrete and steel tube. The composite axial elastic modulus increased linearly as the steel ratio improves. The stress distribution ratios of the concrete core, inner steel tube and outer steel tube were discussed, which was not determined by uniaxial elastic modulus.

Key words: hollow composite CFST   confinement mechanism   theorem of stationary value of potential energy   composite elastic modulus   Possion's ratio

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