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Abstract

The inter-wire contact effect on mechanical performances of a wire rope strand is studied with a new semi-analytical method. The mathematical model of the wire rope strand subjected to axial tension and torsion loads is established first, into which the wire deformation parameters considering the combining effects of Poisson's ratio and inter-wire contact are incorporated. Then this model is solved to achieve the mechanical performances for the wire rope with the semi-analytical method, in which the conjugate gradient method and fast Fourier transform are simultaneously used for calculating the contact deformation, contact pressure and inside stress of the wires caused by the inter-wire contact. The numerical results show that the proposed method is accurate and efficient in evaluating the inter-wire contact behavior. And the large axial load results in the large contact pressure and deformation. The contact deformation results in a reduction in the stiffness of the strand with a lay angle larger than 20°.

Keywords

Wire rope strand; Inter-wire contact; Mechanical performance; Conjugate gradient method; Fast Fourier transform