THE DEFORMATION OF THE HELICAL TYPE WIRE STRUCTURES

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Analysis of power transmission lines (PTL) involves the calculations of static states and vibrations of conductors (and cables) together with spiral accessories, vibration dampers and other devices attached on them. Many of these problems can be properly solved only by taking into consideration the internal structure of the conductors, the design of which is formed by wire layers wound on each other at different angles relative to the longitudinal axis. For example, such reference is required in the design of the systems of power safety and reliability of information-telecommunication supply of aerodromes, aircraft and rocket systems, overhead transmission lines, subject to intense wind, especially in icing conditions.

Due to the complex design of the wire structures the known issues arise in the estimates of their deformations, stiffnesses, bearing capacity, etc. For example, the bending stiffness of the conductor can sufficiently vary as its deformation, since the wire layers may slip relative to each other, and a separate wire is movable within the wire layer. Consequently, the values of stiffnesses can be varied both along the conductor axis and in time.

The work proposes a new deformation model of wires structures which are similar to PTL conductors. These structures include not only conductors and cables, but spiral clamps intended for tension, suspension, joints, protection and repair of conductors.

On the basis of energy averaging, each wire layer is considered as an elastically equivalent anisotropic cylindrical shell, thus a conductor or a spiral clamp are modeled as a system of cylindrical shells nested into each other and interacting by the forces of pressure and friction. Following this approach the formulae for the flexibility and stiffness matrices of spiral structures have been obtained.

The problem of interaction of a tension clamp with the external wire layer of a conductor has been formulated and solved. The mechanism of the force transfer from the clamp on the conductor has been investigated.

Acknowledgments. The work was financially supported by the Russian Ministry of Education and Science (Federal Programme no.14.604.21.0188, ID RFMEFI60417X0188).

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