

SYMMETRICAL AND ANTISYMMETRICAL FORMS OF BENDING VIBRATIONS
OCCURRING IN SPORTING GOODS

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Many of created and employed sporting goods, for instance rackets and ski, belonged to the devices having symmetry of form.

A vibrational state of sporting goods is directly connected with achievement of competition results and may exert negative or healthful influence.

Investigation of natural frequencies of bending vibrations of sporting goods, for example a tennis racket, taking into account parameters of elasticity-plasticity of sportsman's arm, shows an essential influence of them on resonance frequencies spectrum alternation and on resonance creation possibility in the "man arm - racket system" [1]. There was determined on the basis of digital simulation a regularity of alteration of natural frequencies of the system depending on mechanical parameters of an arm, its mass, stiffness in progressive and angular moving.

Values of mentioned parameters depends on individual peculiarities of the arm, manner racket holding and may change depending on different types of shocks execution.

The first natural frequency and corresponding to it type of vibrations are defined by racket vibrations as a rigid body relatively a joint-hinge, arranged in the hand. The second and following natural frequencies and corresponding types of symmetrical and antisymmetrical vibrations defines the frequency of transition of racket vibrations as a rigid body into vibrations of racket as a flexible body. Consequently depending on correlation between elastic-inertial parameters of hand and racket there may arise as symmetrical so and antisymmetrical forms of vibrations. The influence of symmetrical and antisymmetrical forms of vibrations on the quantity of "recoil" on a hand is unequal. There may be observed also in the system "man-ski" arising of symmetrical and antisymmetrical forms of vibrations.

As was determined on the basis of digital simulation, arising of that or another frequency and form of bending vibrations of ski and its amplitudes depend on elastic-inertial connection of body (feet) muscles of a man with a ski track and on correlation between their masses, on hardness of ski track of moving [2].

The boundary and initial conditions must be formulated better for a half of the system, resulting in simplification of derivation of vibration equations. There was determined on the basis of simulation, that the first natural frequency of the system and corresponding to it symmetrical and antisymmetrical forms of bending vibrations must have insignificant vibration amplitudes, what take place in the case of weak coupling of sportsman's body with sport device, in our case with ski. Increasing of rigidity of this coupling leads to corresponding growth of symmetrical vibration amplitudes, and in this case the more ratio of sportsman's mass to ski mass, the more the vibration amplitudes.

The second form of vibration arising in the system is an antisymmetrical one with two vibration nodes.

The symmetrical forms are more preferable to have views for the convenience of its damping, since they give smaller rise to moment component of reaction and contains the number of antisymmetrical form harmonics by unit length and also needs in smaller number of dampers.

References

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