Application of the Kantorovich-Galerkin method for the analysis of resonant systems

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Keywords: emerging mechanical systems, differential operator, resonant amplitude, moving boundaries.

MSC2020 codes: 74H45, 74K05

The article considers the resonant characteristics of nonlinear oscillations of a rope with moving boundaries. The phenomena of resonance and passage through resonance are analyzed. An approximate method has been developed in relation to taking into account the influence of resistance forces and viscoelastic properties on the system. This method also allows considering a wider class of boundary conditions compared to other approximate methods for solving boundary value problems with moving boundaries. The resonance characteristics of viscoelastic rope with moving boundaries using the Kantorovich вЂ" Galerkin method are examined in the article. The phenomenon of resonance and steady passage through resonance are analyzed. One-dimensional systems whose boundaries move are widely used in engineering [1вЂ"5]. The presence of moving boundaries causes considerable difficulties in describing such systems. Exact methods for solving such problems are limited by the wave equation and relatively simple boundary conditions. Of the approximate methods, the Kantorovich-Galerkin method described in [5] is the most efficient. However, this method can also be used in more complex cases. This method makes it possible to take into account the effect of resistance forces on the system, the viscoelastic properties of an oscillating object, and also the weak nonstationarity of the boundary conditions. The paper considers the phenomena of steady-state resonance and passage through resonance for transverse oscillations of a rope of variable length, taking into account viscoelasticity and damping forces. Performing transformations similar to transformations [5], an expression is obtained for the amplitude of oscillations corresponding to the n-th dynamic mode. Expressions are also obtained that describe the phenomenon of steady state resonance and the phenomenon of passage through resonance. The expression that determines the maximum amplitude of oscillations when passing through the resonance was numerically investigated to the maximum. The dependence of the rope oscillation amplitude on the boundary velocity, viscoelasticity, and damping forces is analyzed. The results of numerical studies allow us to draw the following conclusions: - with a decrease in the velocity of the boundary, viscoelasticity and damping forces, the amplitude of oscillations increases; - as the boundary velocity, viscoelasticity and damping forces tend to zero, the oscillation amplitude tends to infinity; In conclusion, we note that the above results make it possible to carry out a quantitative analysis of the steady state resonance and the phenomenon of passage through the resonance for systems whose oscillations are described by the formulated problem.

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