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STABILITY OF A BEAM ON ELASTIC FOUNDATION UNDER DYNAMIC LOAD

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The subject of the theoretical study is a homogeneous beam on elastic foundation under dynamic compression load. The length of the beam is $\boldsymbol{L}$, the thickness is $\boldsymbol{h}$ and the width is $\boldsymbol{b}$. The analytical model of the beam on elastic foundation with taking into account its reaction described by a function $\boldsymbol{c(x)\cdot v(x)}$ is formulated. The coefficient $\boldsymbol{c(x)}$ is the property-foundation constant and $\boldsymbol{v(x)}$ is the deflection of the beam. The property relation is a trigonometric power function.

The equation of motion is in the following form:

$$\boldsymbol{bh\rho\frac{\partial^2 v}{\partial t^2}+EI_z\frac{\partial^4 v}{\partial x^4}+F_0(t)\frac{\partial^2 v}{\partial x^2}+c(x)\cdot v(x)=0}$$

and it is reduced by applying the Galerkin method to ordinary differential equation by substituting the function of deflection $\boldsymbol{v(x,t)=v_a(t)\cdot sin(m\pi x/L)\cdot sin^k(\pi x/L)}$, where $\boldsymbol{v_a(t)}$ is an amplitude of the deflection of the beam, $\boldsymbol{k}$ - power index and $\boldsymbol{m}$ is a natural number. Obtained equation of motion is a second order equation and it is numerically solved with the use of the Runge-Kutta method. The starting impulse is linear or trigonometric function. Dynamic equilibrium paths for the example of the beam with a wide range of parameters are determined and compared.

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