Research on the dynamics of frame structures

[1,2] *Peter G. Velikanov, https://orcid.org/0000-0003-0845-2880, pvelikanov@mail.ru

[2] Yury P. Artyukhin, https://orcid.org/0000-0002-6243-9145, ArtukhinYP@mail.ru

[1] *Kazan National Research Technical University named after A.N. Tupolev – KAI, Kazan, Russia*

[2] *Kazan (Volga Region) Federal University, Kazan, Russia*

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Abstract. Determining the natural and forced oscillations of frame structures simulated by the rods with distributed masses (an infinite number of degrees of freedom) is quite difficult. Therefore, in the article, the frame model is endued with a finite number of degrees of freedom: the mass is placed in a certain number of nodes that elastically interact with rods that have no mass. The rods work only for bending. Longitudinal displacements are not taken into account, since the frequency of longitudinal oscillations is two orders of magnitude higher than the frequency of bending ones. Such a model leads to the construction of expressions of the kinetic and potential energy, which then allows using the Lagrange equations of second kind to obtain a system of differential oscillation equations of the structure. The problem of free oscillations of the G-shaped frame was solved in the article using Green's functions, matrices of stiffness, masses, malleability, etc. The obtained approximate results were compared with little-known exact results and demonstrated good convergence, especially with an increase in the number of degrees of freedom (the number of concentrated masses simulating the distributed mass of the rods of the G-shaped frame).

Keywords:

oscillations of frames, oscillation frequencies, Green's function,

stiffness matrix, mass matrix, malleability matrix

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