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NUMERICAL AND EXPERIMENTAL APPROACHES TO DETERMINING THE FREQUENCIES OF FREE VIBRATIONS OF PLATES OF COMPLEX SHAPE

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The design of buildings and frames of various machines and structures requires preliminary calculations for stability and strength. The calculation of the frequencies of free vibrations is important, since in real operating environments it is necessary to avoid destructive resonance conditions. Plates of different shapes, with different apertures and with different boundary conditions, are used to construct such structures. An urgent problem of mechanics arises about the extension of analytical, numerical and experimental methods to solving problems of the dynamics of plates of various shapes. Currently, a variety of computer-aided design software systems, based on various numerical methods – the finite element method (FEM), for example – are widely used to solve this problem. One such system is FEMAP with the NX Nastran solver, which has been tested on a large number of problems of plate dynamics [1-3]; the calculation results strongly agree with results obtained experimentally [3]. In addition to FEM, there are numerous other methods. In [4], for example, the frequencies of free vibrations of a square plate with rigidly fixed edges were calculated using the Rayleigh-Ritz formula; again, the calculation results strongly agree with the results obtained by other authors using experimental and numerical methods.

The purpose of this study is to determine the frequencies and modes of free vibrations of an isotropic thin five-pointed plate with free edges using the Rayleigh-Ritz formula and the Chladni's experiment. The geometry of the five-pointed plate, the physical and mechanical characteristics of the material, and mashingby finite elements are selected in accordance with the plate considered in [2].

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