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Investigation of Free Vibrations of Opened Shells from Alloy D19: Assistance of the Associated Mass System

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Abstract : Cylindrical shells are widely used in the construction of buildings and structures, as well as in the air structure. Thin-walled casings made of aluminum alloys are an effective substitute for reinforced concrete and steel structures in construction. The correspondence of theoretical calculations and the actual behavior of aluminum alloy structures is to ensure their trouble-free operation. In the laboratory of our university, "Building Constructions" conducted an experimental study to determine the effect of the system of attached masses on the natural oscillations of shallow cylindrical shells of aluminum alloys, the results of which were compared with theoretical calculations. The purpose of the experiment is to measure the free oscillations of an open, sloping cylindrical shell for various variations of the attached masses. Oscillations of an open, slender, thin-walled cylindrical shell, rectangular in plan, were measured using induction accelerometers. The theoretical calculation of the shell was carried out on the basis of the equations of motion of the theory of shallow shells, using the Bubnov-Galerkin method. A significant splitting of the flexural frequency spectrum is found, influenced not only by the systems of attached masses but also by the values of the wave formation parameters, which depend on the relative geometric dimensions of the shell. The correspondence of analytical and experimental data is found, using the example of an open shell of alloy D19, which allows us to speak about the high quality of the study. A qualitative new analytical solution of the problem of determining the value of the oscillation frequency of the shell, carrying a system of attached masses is shown.

Keywords : open hollow shell, nonlinear oscillations, associated mass, frequency
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