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Nonlinear Vibrations of Shallow Shells and Thin Plates of Arbitrary Shape

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Large amplitude free vibrations of thin plates and shallow shells which are described by Donnell–Mushtari–Vlasov differential equations are considered. For the solution of the problem for plates and shallow shells of the complex form an effective method are proposed. It consists in the approximating of solution of initial nonlinear system of the equations by single mode approximation, which is the product of the eigenfunction appropriate to the basic frequency of linear vibration and time-dependent function. As a result of an application of variational Galerkin procedure, the problem is reduced to research of the second order nonlinear ordinary differential equation with respect to amplitude parameter. The distinctive feature of the offered method is the defining eigenfunctions in an analytical kind by the R-function theory (RFM). This fact allows to find natural frequencies for the plate or shallow shell median surface in any form and various type of boundary conditions. The given numerical results and their comparison with well-known from other works confirms the reliability and efficiency of the suggested method.

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