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Oscillations of flexible orthotropic meshed micropolar Timoshenko's plate

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Abstract: The oscillation's theory of a geometrically nonlinear micropolar orthotropic meshed plate under the action of a normal distributed load is constructed in this paper. The plate's material as a Cosserat continuum with constrained particle rotation (pseudocontinuum). As a result, an additional independent parameter of length l associated with the symmetric bending-torsion tensor will appear in the model. The panel consists of n sets of identical edges, what allows to apply the continuous G. I. Pshenichnov's model. The equilibrium equations for the plate element and the boundary conditions are obtained from the Ostrogradskyi-Gamilton variation principle on the basis of S. P. Timoshenko's kinematic hypotheses. Geometric nonlinearity is taken into account according to the Theodore von Karman model. The system of differential equations in partial derivatives is reduced to a system of ODE using the finite difference method of the second order of accuracy. The resulting system is solved by the fourth-order Runge-Kutta methods. The influence of the normal load, an additional length's parameter l, and mesh's geometry on the orthotropic plate's oscillations consisting of two families of mutually orthogonal edges has been studied. The work was supported by the RFBR, № 18-01-00351a

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