INDEPENDENT SOLUTION OF THE MAGNETOELASTICS PROBLEM OF THIN COMPOUND-SHAPED ANISOTROPIC PLATES

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Abstract: In this work is devoted to the construction of a mathematical model based on the Hamilton-Ostrogradsky variational principle. The Kirchhoff-Love hypothesis was used to convert a three-dimensional model to a two-dimensional model. The variation of potential and kinetic changes and changes in the works of external forces were estimated. Using Cauchy relationships, Hooke's law and Maxwell's electromagnetic tensor in a geometric linear form, the effects of electro-magnetic-elasticity on the stressed deformation condition of the elastic plate were gained. Presents an independent solution to the problem of magneto elasticity of thin complex-shaped anisotropic plates. Electrodynamic forces are considered stationary. In this work, computational experiments were performed for (anisotropic) plates made of different materials under different boundary conditions, positive results were obtained and analyzed.

Key words: Independent magnetoelastic problem, Mathematical model, anisotropic plate, Hamilton-Ostrogradsky variational principle, calculation algorithm, Bubnov-Galerkin method, R-function method (RFM).

INTRODUCTION.

Modern engineering practice requires consideration of various anisotropic properties of plates. Consideration of anisotropic properties complicates the mathematical model of the deformation processes of thin plates. In addition, considering geometric nonlinearity complicates the mathematical model of the plates, represented by a system of nonlinear differential equations under appropriate boundary conditions. It is proven that the complex geometric shape of the plate will cause difficulties for engineers to perform pre-design calculations. Therefore, in this scientific work, electrodynamic forces are considered stationary. Researches were conducted on mathematical modeling of independent magnetoelastic deformation processes of flexible thin anisotropic plates with complex shapes.

The authors in [2] developed the Kirchhoff plate theory to study the nonlinear free vibrations dependent on the functional order parameters of a flexoelectric nanoplate under the influence of a magnetic field and developed a thermo-electromechanical model based on a modified flexoelectric concept. By using the methods of the calculus of variations and Hamilton's principle, nonlinear controlling differential equations and the boundary conditions associated with them are obtained, and the controlling equations are solved using the Galerkin and oscillation methods.

In an article by Ali Kiani, Moslem. Sh. et al. [3], in accordance with the theory of nonlocal elasticity of plates subjected to third-order deformation, in a visco-Pasternak medium, a theoretical analysis of the reaction of thermomechanical vibrations of magneto-electro-thermoelastic nanoplates made of functional-gradient materials was carried out. Results were obtained on the effect of initial external energy, magnetic fields, and temperature on a magneto-electro-thermoelastic nanoplate.

Article [4] developed a mathematical model for the problem of deformation of the side walls of a plate under the influence of heat. Specific expressions for uniform stress indicators corresponding to some significant classes of anisotropic bodies are obtained, and their dependence on parameters is also presented [5]. A mathematical model of stress and deformation of rods under the influence of spatial loading taking into account temperature based on the Hamilton-Ostrogradsky variational principle was developed in [6].

The authors in [7] studied the dynamic response of a truncated conical shell in a magnetic field, taking into account the time of thermo-magnetoelastic influences, and analyzed the dynamic reactions of displacement of a truncated conical shell under the influence of electromagnetic and temperature fields. A model of a plate with localized first-order deformation is presented to study the bending of magnetic-electro-thermoelasticity of nanoplates under the influence of magnetic, electrical, thermal, and mechanical loads [8].

The article [9] studied mixed boundary value problems of generalized thermo-electromagnetic elasticity for homogeneous anisotropic solids with internal cracks. The research theory under consideration takes into account the Green-Lindsay model of thermo-electromagnetic elasticity, which fully describes the relationship between elasticity, electric, magnetic, and thermal fields. The effects of non-local parameters, boundary conditions, increased temperature loads, external electrical stress, and external magnetic field on the critical bending stress and subsequent post-bending response were studied[10].

Researchers S.A. Ambartsumyan, G.E. Bagdasaryan, M.V. Belubekyan, V.L. Rvachev, L.V. Kurpa, L.V. Molchenko, I.T. Selezov, M.R. Korotkina, Kh. A. Rakhmatulin, V.K. Kabulov, Sh.A.Nazirov, T.Yuldashev, A.A.Khaldzhigitov, R.Indiaminov, F.M.Nuraliev, Sh.A.Anarova conducted research on the theory of electromagnetic elasticity and its solution [1,16].

PROBLEM FORMULATION

The issue of vibration (bending) of an anisotropic thin plate made of conductive material with a constant thickness and it is equal to h in an electromagnetic field is considered. Here, the magnetic and electric field strengths are given in advance. External currents and charges are assumed to be unaffected. The plate is located in the Cartesian coordinate system x, y, z in such a way that the middle plane of the plate overlaps with the x, y plane [16, 19].

To get the equations of motion of the plate, the following Kirchhoff-Liav hypothesis is used as the change laws of displacement. In this case, it is assumed that there is no deformation of the thin plate along the Oz coordinate axis, and the displacement projections of the middle plane of the plate are expressed as follows [1, 19]:

$$u_1 = u(x,y,t) - z\frac{\partial w}{\partial x},\ u_2 = v(x,y,t) - z\frac{\partial w}{\partial y},\ u_3 = w(x,y,t) \tag{1}$$

Where u, v, w are movements

MATHEMATICAL MODEL OF THE PROBLEM.

The mathematical model for a thin plate located in an electromagnetic field is obtained based on the Hamilton-Ostrogradsky variational principle and electrodynamic equations in the form of Maxwell's equations [1]. An overview of the Hamilton-Ostrogradki variational principle [1, 19] is as follows:

$$\int_t (\delta K - \delta \Pi + \delta A)dt = 0; \tag{2}$$

where $\delta -$ variational operation, $K -$ kinetic energy, $\Pi -$ potential energy, $A -$ work done by external volume and surface forces.

Based on the Hamilton-Ostrogradsky variational principle, the effects of the electromagnetic field on the geometrically nonlinear deformation of a thin complex-shaped magnetoelastic plate is considered using the Cauchy relationship, Hooke's law, and Maxwell's electromagnetic tensor. As a result, a mathematical model (3)-(5) in the form of a system of differential equations with initial and boundary conditions for displacement was obtained [20]:

$$\begin{cases} -\rho h \dfrac{\partial^2 u}{\partial t^2} + \dfrac{\partial N_{11}}{\partial x} + \dfrac{1}{2}\dfrac{\partial N_{12}}{\partial y} + N_x + R_x + q_x + T_{zx} = 0, \\ -\rho h \dfrac{\partial^2 v}{\partial t^2} + \dfrac{1}{2}\dfrac{\partial N_{12}}{\partial x} + \dfrac{\partial N_{22}}{\partial y} + N_y + R_y + q_y + T_{zy} = 0, \\ -\rho h \dfrac{\partial^2 w}{\partial t^2} + \dfrac{\partial}{\partial x}(N_{11}\dfrac{\partial w}{\partial x} + \dfrac{1}{2}N_{12}\dfrac{\partial w}{\partial y}) + \dfrac{\partial}{\partial y}(\dfrac{1}{2}N_{12}\dfrac{\partial w}{\partial x} + N_{22}\dfrac{\partial w}{\partial y}) + \\ + \dfrac{\partial^2 M_{11}}{\partial x^2} + \dfrac{\partial^2 M_{12}}{\partial x \partial y} + \dfrac{\partial^2 M_{22}}{\partial y^2} + N_z + R_z + q_z + T_{zz} = 0, \end{cases} \tag{3}$$

Initial conditions:

$$\rho h \frac{\partial u}{\partial t}\delta u\Big|_t = 0, \rho h \frac{\partial v}{\partial t}\delta v\Big|_t = 0, \rho h \frac{\partial w}{\partial t}\delta w\Big|_t = 0, \rho \frac{h^3}{12}\frac{\partial^2 w}{\partial t \partial x}\delta w\Big|_x\Big|_t = 0,\ \rho \frac{h^3}{12}\frac{\partial^2 w}{\partial t \partial y}\delta w\Big|_y\Big|_t = 0; \tag{4}$$

Boundary conditions:

$$\begin{cases} N_{11}\delta u\big|_x = 0,\ \dfrac{1}{2}N_{12}\delta v\Big|_x = 0,\ -M_{11}\delta \dfrac{\partial w}{\partial x}\Big|_x = 0,\ -\dfrac{1}{2}M_{12}\delta\dfrac{\partial w}{\partial y}\Big|_x = 0, \\ \left[N_{11}\dfrac{\partial w}{\partial x} + \dfrac{1}{2}N_{12}\dfrac{\partial w}{\partial y} - \dfrac{\partial M_{11}}{\partial x} - \dfrac{1}{2}\dfrac{\partial M_{12}}{\partial y}\right]\delta w\Big|_x = 0, \\ \left[\left(N_{Px} + N_{Txx}\right)\delta u + \left(N_{Py} + N_{Txy}\right)\delta v + \left(N_{Pz} + N_{Txz}\right)\delta w\right]\Big|_x = 0, \\ N_{22}\delta v\big|_y = 0,\ \dfrac{1}{2}N_{12}\delta u\big|_y = 0,\ -M_{22}\delta\dfrac{\partial w}{\partial y}\Big|_y = 0,\ -\dfrac{1}{2}M_{12}\delta\dfrac{\partial w}{\partial x}\Big|_y = 0, \\ \left[N_{22}\dfrac{\partial w}{\partial y} + \dfrac{1}{2}N_{12}\dfrac{\partial w}{\partial x} - \dfrac{\partial M_{22}}{\partial y} - \dfrac{1}{2}\dfrac{\partial M_{12}}{\partial x}\right]\delta w\Big|_y = 0, \\ \left[\left(N_{Fx} + N_{Tyx}\right)\delta u + \left(N_{Fy} + N_{Tyy}\right)\delta v + \left(N_{Fz} + N_{Tyz}\right)\delta w\right]\Big|_y = 0. \end{cases} \tag{5}$$

where $u, v, w -$ movements; ρ – density of the material under consideration; $h -$ thickness of the plate; M_{11}, M_{22}, M_{12} - bending and twisting moments; N_{11}, N_{22}, N_{12} - normal and impact forces; $N_x, N_y, N_z, R_x, R_y, R_z$ – the organizers of the volume forces; $T_{zx}, T_{zy}, T_{zz}, q_x, q_y, q_z$ – the organizers of the surface forces; $N_{Px}, N_{Py}, N_{Pz}, N_{Fx}, N_{Fy}, N_{Fz}, N_{Txx}, N_{Txy}, N_{Txz}, N_{Tyx}, N_{Tyy}, N_{Tyz}$ – the organizers of the contour forces.

Based on equation (3), we determine the bending and twisting moments, and normal and impact forces in the equations of geometric nonlinear motion of anisotropic flexible thin plates. These moments and forces are determined by the following relationships [9-11]:

$$\begin{gathered} N_{11} = \int_{-h/2}^{h/2} \sigma_{11} dz,\ N_{22} = \int_{-h/2}^{h/2} \sigma_{22} dz,\ M_{11} = \int_{-h/2}^{h/2} z\sigma_{11} dz, \\ M_{22} = \int_{-h/2}^{h/2} z\sigma_{22} dz, N_{12} = \int_{-h/2}^{h/2} \sigma_{12} dz, M_{12} = \int_{-h/2}^{h/2} z\sigma_{12} dz. \end{gathered} \tag{6}$$

Taking into account that the plate is made of anisotropic material Hooke's law is expressed as follows [11,12]:

$$\begin{aligned} \sigma_{11} &= B_{11}\varepsilon_{11} + B_{12}\varepsilon_{22} + B_{16}\varepsilon_{12}, \\ \sigma_{22} &= B_{12}\varepsilon_{11} + B_{22}\varepsilon_{22} + B_{26}\varepsilon_{12}, \\ \sigma_{12} &= B_{16}\varepsilon_{11} + B_{26}\varepsilon_{22} + B_{66}\varepsilon_{12}. \end{aligned} \tag{7}$$

where, $\varepsilon_{11}, \varepsilon_{12}, \varepsilon_{22} -$ deformation tensor components; $\sigma_{11}, \sigma_{12}, \sigma_{22} -$ stress tensor components; $B_{ij}\left(i, j = 1, 2, 6\right) -$ elastic coefficients of the plate material [12].

Determined bending and twisting moments and normal and impact forces are applied to (3) - (5). As a result, we have a geometric nonlinear mathematical model of the problem of vibration of thin anisotropic plates located in an electromagnetic field [1]. This problem is solved in the appropriate boundary conditions, depending on the methods of fixing the boundaries of thin complex-shaped plates under investigation [17, 16].

PROPOSED ALGORITHM

In order to numerically solve the problems (3)-(5) above, we developed a calculation algorithm that uses the analytical R-function method (RFM), the Newmark method, the variational Bubnov-Galerkin method, and a number of numerical methods for magneto-elastic plates with a complex structural shape. developed [13-16, 18-22]. Thus, the process of solving problems consists of the following steps:

1. Application of the linearization method in solving systems of differential equations with nonlinear partial derivatives.
2. Construction of a sequence of coordinate functions corresponding to the given boundary conditions (structures of solutions) using V.L. Rvachev's R-function method (RFM).
3. Discretization with respect to spatial variables, discrete equations, that is, construction of discrete equations using the Newmark method and the Bubnov-Galerkin variational method.
4. Solving discrete equations and finding unknown components of solution structures.
5. Identification of unknown functions. Determination of tangential and normal displacements of the middle surface of the plate.

When solving the problem using iterative numerical methods based on the above steps, functions $u_i(x, y, t), v_i(x, y, t)$ and $w_i(x, y, t)$ are determined for each iteration. The iteration step continues until the condition $\max\left\{\left|u_i - u_{i-1}\right|, \left|v_i - v_{i-1}\right|, \left|w_i - w_{i-1}\right|\right\} \leq \varepsilon$ ($\varepsilon -$ fixed precision) is met.

CALCULATION RESULTS.

In solving the studied problem, calculations were performed for plates made of different materials (isotropic, anisotropic) under different boundary conditions. Positive results were obtained and analyzed [20-22]. As an example, let's consider a plate with a complex shape, which is used in the production of an electric transformer and is under the influence of electromagnetic field forces (Fig. 1).

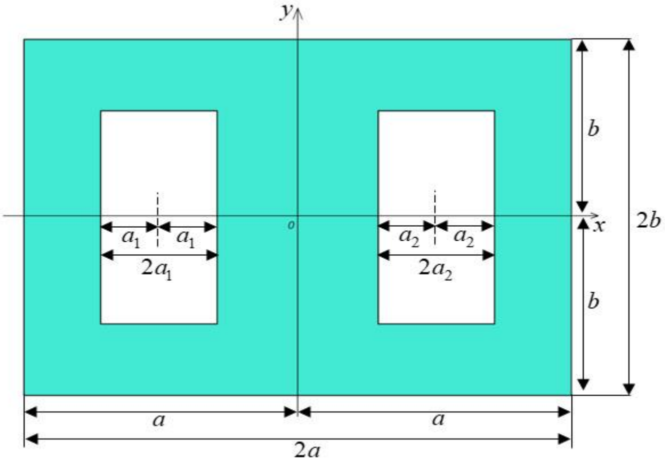

Figure 1. A plate with a complex shape

First, we develop the analytical equation of a thin plate of complex shape using the R-function method. In this case, the transition from logical functions to the construction of analytical equations is carried out on the basis of RFM, using the following formulas [13-15, 22]:

$$f_1 \wedge_\alpha f_2 \equiv \frac{1}{1+\alpha}\left(f_1 + f_2 - \sqrt{f_1^2 + f_2^2 - 2\alpha f_1 f_2}\right) \text{ (when R is a conjunction)}$$

$$f_1 \vee_\alpha f_2 \equiv \frac{1}{1+\alpha}\left(f_1 + f_2 + \sqrt{f_1^2 + f_2^2 - 2\alpha f_1 f_2}\right) \text{ (when R is a disjunction),}$$

$$\overline{f} - \text{ (when R is negation).}$$

Here $\alpha \equiv \alpha(x, y)$ - function is located in the range $-1 < \alpha \le 1$. In particular $\alpha = 0$.

In this case, the boundary equation of the complex field given in Figure 1 above is expressed in the following form:

$$\Omega = f_{12} \wedge f_{34} \wedge f_{56}. \tag{8}$$

Here:

$$f_{12} = f_1 \wedge f_2 = a^2 - x^2 + b^2 - y^2 - \sqrt{\left(a^2 - x^2\right)^2 + \left(b^2 - y^2\right)^2} \ge 0,$$

$$f_1 = \left(a^2 - x^2\right) \ge 0, \quad f_2 = \left(b^2 - y^2\right) \ge 0;$$

$$f_{34} = f_3 \wedge f_4 = \left(x - \frac{a}{2}\right)^2 - a_1^2 + y^2 - b_1^2 - \sqrt{\left(\left(x - \frac{a}{2}\right)^2 - a_1^2\right)^2 + \left(y^2 - b_1^2\right)^2} \ge 0,$$

$$f_3 = \left(\left(x - \frac{a}{2}\right)^2 - a_1^2\right) \ge 0, \quad f_4 = \left(y^2 - b_1^2\right) \ge 0;$$

$$f_{56} = f_5 \wedge f_6 = \left(x + \frac{a}{2}\right)^2 - a_2^2 + y^2 - b_2^2 - \sqrt{\left(\left(x + \frac{a}{2}\right)^2 - a_2^2\right)^2 + \left(y^2 - b_2^2\right)^2} \ge 0,$$

$$f_5 = \left(\left(x + \frac{a}{2}\right)^2 - a_2^2\right) \ge 0, \quad f_6 = \left(y^2 - b_2^2\right) \ge 0.$$

Now, we study the process of geometrical nonlinear deformation of magnetoelastic anisotropic plates of thin complex shapes.

Calculation experiment 1. In this study, the change of deformation states under the influence of electromagnetic field forces when the plate with fixed boundaries is isotropic (copper) or anisotropic (anisotropic copper) was studied, that is, along the axis, in the values of $x \in [-2;2], y=0, t=1$ numerical results of the displacement function were obtained. Taking into account that the displacement function values are not available in the sheared parts of the plate, these intervals are omitted in the table (Table 1).

Table 1. Numerical results od states of magnetoelasticity of isotropic and anisotropic plates.

x	*Izotropic plate* ***W(x,y,t)***	*Anizotropic plate* ***W(x,y,t)***	**x**	*Izotropic plate* ***W(x,y,t)***	*Anizotropic plate* ***W(x,y,t)***
-2	0	0	2	0	0
-1,9	0,000676	0,000429	1,9	0,000676	0,000429
-1,8	0,001972	0,001254	1,8	0,001972	0,001254
-1,7	0,001881	0,001197	1,7	0,001881	0,001197
-1,6	0,000693	0,000442	1,6	0,000693	0,000442
-1,5	0	0	1,5	0	0
-0,5	0	0	0,5	0	0
-0,4	0,000479	0,000312	0,4	0,000479	0,000312
-0,3	0,001662	0,001083	0,3	0,001662	0,001083
-0,2	0,003054	0,001993	0,2	0,003054	0,001993
-0,1	0,004143	0,002705	0,1	0,004143	0,002705
0	0,004551	0,002972	0	0,004551	0,002972

Graphical results are presented and analyzed for a complete visualization of the process in the study of the state of geometric nonlinear deformation of thin isotropic and anisotropic plates of complex structural shape under the influence of electromagnetic field forces (Fig. 2). It can be seen from the Figure 2 that the process under study is tilted along the Oz axis as seen from the Ox axis.

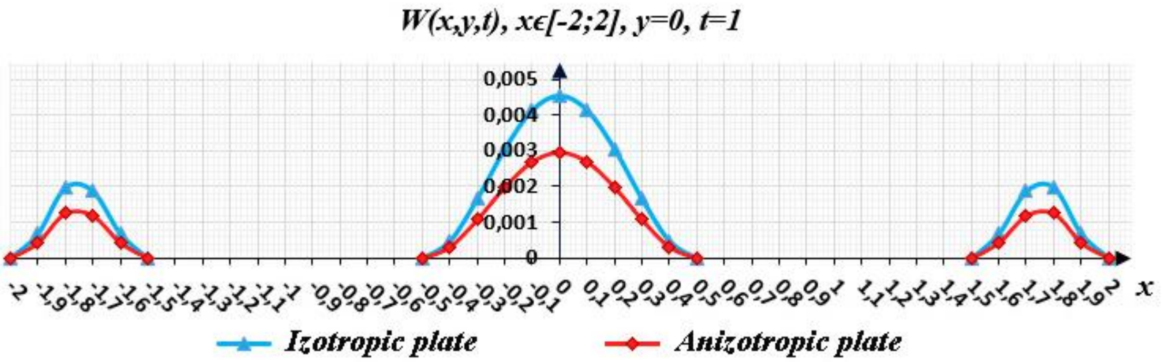

Figure 2. Graphical analysis of magnetoelastic states of isotropic and anisotropic plates

Research results show that when the plate is anisotropic, it bends up to 34% less than isotropic. This, in turn, shows that the anisotropic plate is more resistant to external forces than the isotropic one.

Calculation experiment 2. Experimental experiments were conducted to study the effect of electromagnetic field during the geometrical nonlinear deformation of thin complex-shaped anisotropic plates. Numerical values and graphics of the displacement function (*xϵ[-2;2], y=0, t=1*) *w(x,y,t)* of the plate with and without electromagnetic field forces are illustrated in table 2 and and fig. 3.

Table 2. Numerical results obtained for evaluating the influence of electromagnetic field forces on the bending of an anisotropic plate along the OZ axis

x	*The effect of electromagnetic field forces is not considered* ***W(x,y,t)***	*Under the influence of electromagnetic field forces* ***W(x,y,t)***	***x***	*The effect of electromagnetic field forces is not considered* ***W(x,y,t)***	*Under the influence of electromagnetic field forces* ***W(x,y,t)***
-2	0	0	2	0	0
-1,9	0,000346	0,000429	1,9	0,000346	0,000429
-1,8	0,001012	0,001254	1,8	0,001012	0,001254
-1,7	0,000966	0,001197	1,7	0,000966	0,001197
-1,6	0,000356	0,000442	1,6	0,000356	0,000442
-1,5	0	0	1,5	0	0
-0,5	0	0	0,5	0	0
-0,4	0,000252	0,000312	0,4	0,000252	0,000312
-0,3	0,000874	0,001083	0,3	0,000874	0,001083
-0,2	0,001608	0,001993	0,2	0,001608	0,001993
-0,1	0,002183	0,002705	0,1	0,002183	0,002705
0	0,002399	0,002972	0	0,002399	0,002972

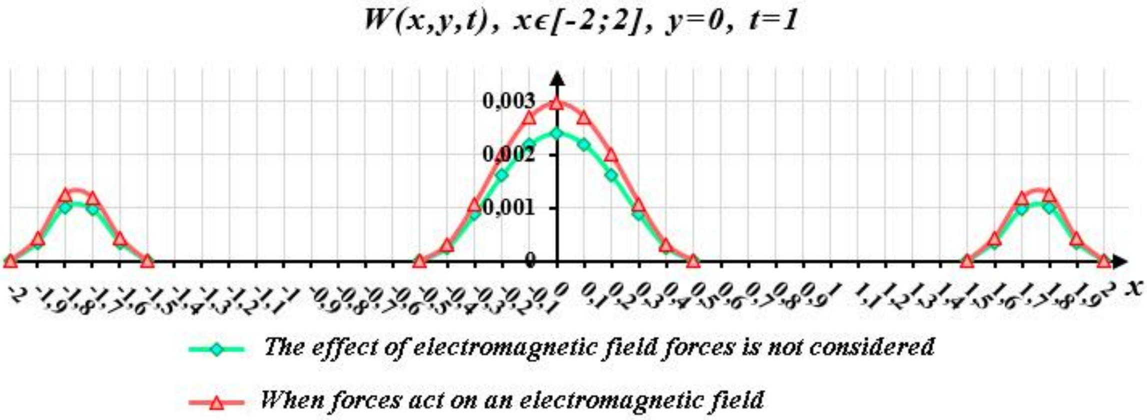

Figure 3. Effect of electromagnetic field forces on anisotropic plate

The result of the study showed that the influence of the electromagnetic field forces on the bending of the anisotropic plate along the OZ axis is up to 19%.

Calculation experiments 3, and 4 were performed by changing the geometrical parameters of the investigated complex area, that is, for a plate with a thickness of h=0.02. One of the two rectangles crossing the plates has been resized. As a result, plates with assymmetrical shape and tightly fixed borders were formed.

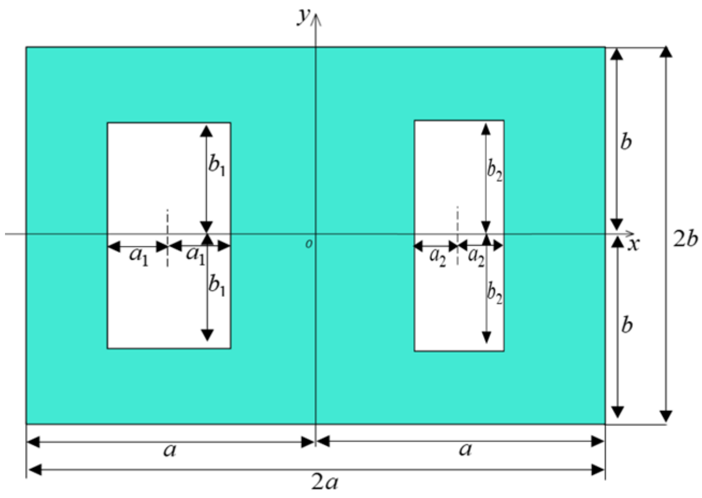

Figure 4. A plate with a thin complex symmetrical shape

Calculation experiment 3. In this study, the magnetoelastic deformation of a rigidly fixed isotropic (copper) or anisotropic (anisotropic copper) plate with symmetric boundaries is investigated. That is, the numerical results of the displacement function $w(x,y,t)$ *along the OZ axis at* $x \in [-2;2], y=0, t=1$ *were obtained (Table 3), and the results were also depicted graphically in Fig. 4.*

Table 3. Numerical results of magnetoelastic states of isotropic and anisotropic plates of symmetric shape

x	*Isotropic plate* ***W(x,y,t)***	*Anisotropic plate* ***W(x,y,t)***	***x***	*Isotropic plate* ***W(x,y,t)***	*Anisotropic plate* ***W(x,y,t)***
-2	0	0	2	0	0
-1,9	0,000190	0,000100	1,9	0,001171	0,000772
-1,8	0,000708	0,000399	1,8	0,003620	0,002386
-1,7	0,000824	0,000483	1,7	0,003943	0,002596
-1,6	0,000359	0,000216	1,6	0,002141	0,001409
-1,5	0	0	1,5	0,000347	0,000228
-0,5	0	0	1,4	0	0
-0,4	0,000669	0,000441	0,6	0	0
-0,3	0,002407	0,001589	0,5	0,000221	0,000146
-0,2	0,004569	0,003020	0,4	0,001480	0,000977
-0,1	0,006399	0,004231	0,3	0,003460	0,002286
0	0,007282	0,004816	0,2	0,005506	0,003640
			0,1	0,006942	0,004590

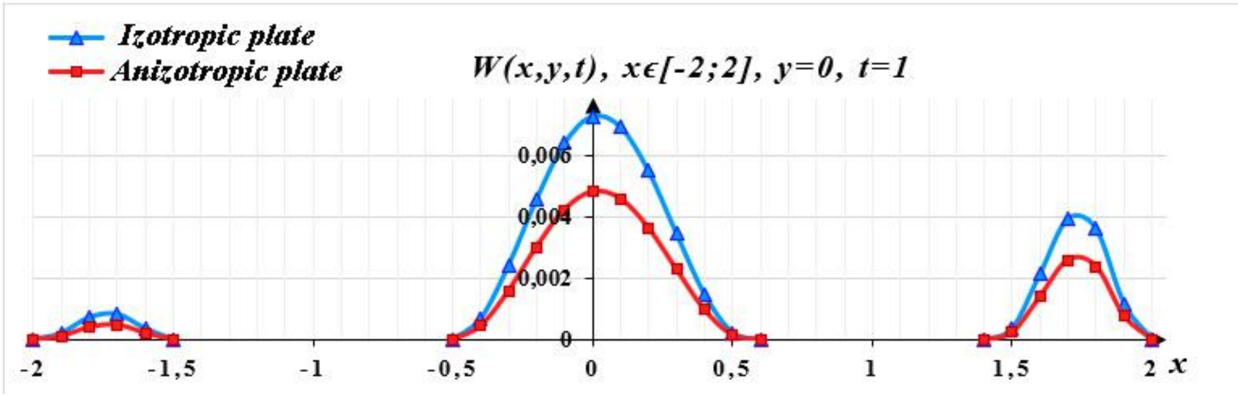

Figure 4. Graphical analysis of magnetoelastic states of isotropic and anisotropic plates of symmetrical shape.

From the results of this study, it was found that when a symmetrical plate is anisotropic, it bends up to 33% less than isotropic.

Calculation experiment 4. In this study, computational experiments were conducted to study the effect of electromagnetic field forces on the process of geometric nonlinear deformation of anisotropic plates of thin complex symmetrical shape. In this case, the results of the bending of a symmetric anisotropic plate with and without the influence of electromagnetic field forces were obtained (Table 4, Figure 5).

Table 4. Numerical results obtained for evaluating the influence of electromagnetic field forces on the bending of a symmetric anisotropic plate along the OZ axis.

x	*The effect of electromagnetic field forces is not considered* ***W(x,y,t)***	*Under the influence of electromagnetic field forces* ***W(x,y,t)***	***x***	*The effect of electromagnetic field forces is not considered* ***W(x,y,t)***	*Under the influence of electromagnetic field forces* ***W(x,y,t)***
-2	0	0	2	0	0
-1,9	0,000081	0,000100	1,9	0,000623	0,000772
-1,8	0,000322	0,000399	1,8	0,001925	0,002386
-1,7	0,000390	0,000483	1,7	0,002095	0,002596
-1,6	0,000175	0,000216	1,6	0,001137	0,001409
-1,5	0	0	1,5	0,000184	0,000228
-0,5	0	0	1,4	0	0
-0,4	0,000356	0,000441	0,6	0	0
-0,3	0,001282	0,001589	0,5	0,000118	0,000146
-0,2	0,002437	0,003020	0,4	0,000789	0,000977
-0,1	0,003415	0,004231	0,3	0,001845	0,002286
0	0,003887	0,004816	0,2	0,002937	0,003640
			0,1	0,003704	0,004590

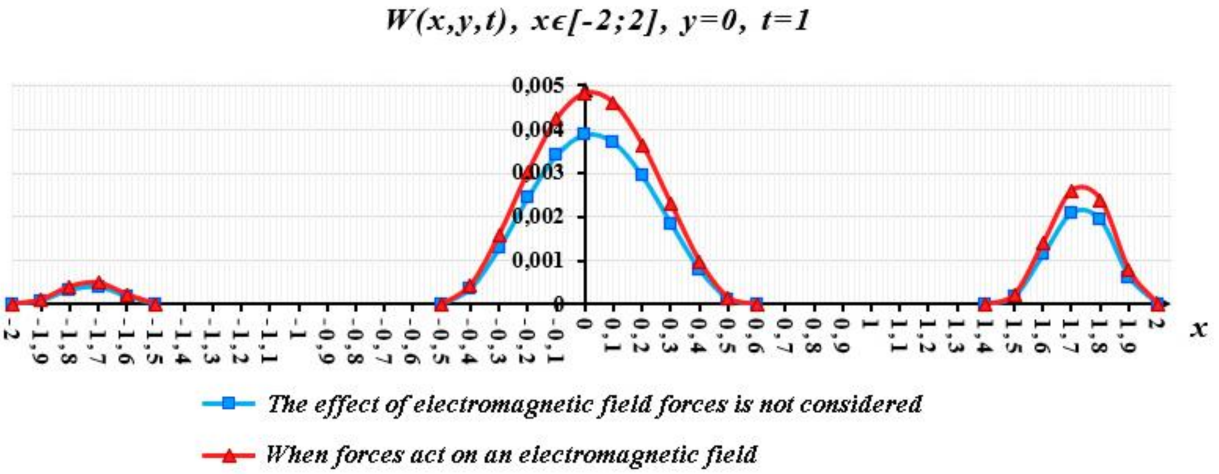

Figure 5. Effects of electromagnetic field forces on a thin anisotropic plate of complex shape when it is symmetric.

The results of computational experiments show that the influence of electromagnetic field forces on the bending of a thin anisotropic symmetric plate along the OZ axis is up to 19.2%.

Analysis of results

The analysis of the results of the research shows that when the plate is anisotropic, it bends 33-34% less than isotropic. This, in turn, shows that the anisotropic plate is more resistant to external forces than the isotropic one.

An anisotropic plate bends 19% less than an isotropic plate. So, it was found that the influence of electromagnetic field forces on the deformation process of thin complex-shaped magnetoelastic anisotropic plates is small.

Conclusion.

In this article, research is conducted on independently solving the problem of geometric nonlinear deformation of magnetoelastic anisotropic plates of thin complex shapes. First, a mathematical model of the problem and a calculation algorithm were developed. In the study of this issue, the construction of the boundary equation of the considered complex area using RFM was considered. Computational experiments were conducted to study the influence of electromagnetic field forces on the geometric nonlinear deformation of thin complex (symmetric and asymmetric) shaped (isotropic and anisotropic) plates under investigation, and the obtained results were analyzed.

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