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ИЗВЕСТИЯ НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК АРМЕНИИ

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PROPAGATION CHARACTER OF PLANE VOLUME WAVES IN ELASTIC MAGNETOSTRICTIVE MEDIA

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ХАРАКТЕР РАСПРОСТРАНЕНИЯ ПЛОСКИХ ОБЪЕМНЫХ ВОЛН В УПРУГИХ МАГНИСТОСТРИКЦИОННЫХ СРЕДАХ

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Исследован характер распространения плоских объемных волн в диэлектрической магнистострикционной среде в присутствии постоянного магнитного поля. Исследования были проведены на основе линейных дифференциальных уравнений и соответствующих условий, описывающие поведение возбуждений в магнитострикционных средах, взаимодействующие с магнитными полями. Показано, что имеются три типа волн, которые могут распространяться в магнитострикционной среде: квазипродольная магнитострикционно связанная, квазипоперечная магнитострикционно связанная и поперечная несвязанная. Более того, несвязанная та волна, в которой материальные частицы среды колеблятся перпендикулярно той поверхности, которая формируется направлениями данного магнитного поля и распространения волны. Поведение вышеупомянутых волн исследовано в зависимости как от интенсивности магнитного поля, так и от ориентации магнитного поля относительно плоскости распространения волны.

Գ.Ե.Բաղդասարյան, Վ.Գ.Գարակով, Զ.Ն.Դանոյան, Մ.Ա.Միկիլյան

Հարթ ծավալային ալիքների տարածման վարքը առաձգական մագնիսաստրիկցիոն միջավայրերում

Հետազոտված է դիէլեկտրիկ մագնիսաստրիկցիոն միջավայրում ծավալային հարթ ալիքների տարածման բնույթը մագնիսական դաշտի առկայությամբ: Հետազոտությունները կատարված են մագնիսական դաշտերի հետ փոխազդեցության մեջ գտնվող մագնիսաստրիկցիոն միջավայրերի գրգռումների վարքը նկարագրող դիֆերենցիալ հավասարումների և համապատասխան պայմանների հիման վրա: Ցույց է տրված, որ գոյություն ունեն երեք տիպի ալիքներ, որոնք կարող են տարածվել մագնիսաստրիկցիոն միջավայրում. քվազիերկայնական մագնիսաստրիկցիոնապես կապակցված, քվազիընդլայնական մագնիսաստրիկցիոնապես կապակցված և ընդլայնական չկապակցված: Ավելին, կապակցված չէ այն ալիքը, որում միջավայրի մասնիկները տատանվում են այն հարթությանը ուղղահայաց, որը կազմվում է տրված մագնիսական դաշտի և ալիքի տարածման ուղղություններով: Վերը նշված ալիքների վարքը հետազոտված է կախված ինչպես մագնիսական դաշտի ինտենսիվությունից, այնպես էլ ալիքների տարածման հարթության նկատմամբ մագնիսական դաշտի ուղղվածությունից:

The character of propagation of plane volume waves in elastic dielectric magnetostrictive media in the presence of constant magnetic field is investigated. Investigations have been done on the basis of linear differential equations and conditions describing the perturbation behavior in elastic magnetostrictive media interacting with magnetic fields. It is shown that there are three types of waves that can be propagated in the elastic magnetostrictive media: quasilongitudinal magnetostrictionally coupled, quasitransversal magnetostrictionally coupled and transversal uncoupled. Moreover, uncoupled is that wave in which the material particles of the medium are vibrated perpendicular to the plane which is formed by the direction of given magnetic field and wave propagation. Behavior of the above-mentioned waves is investigated depending on both the intensity of magnetic field, as well as magnetic field's orientation with respect to the plane of wave propagation.

1. Introduction

Currently there are many works where several problems of propagation of electromagnetoelastic waves in solids are investigated. They are mainly devoted to the wave processes in conductive non-ferromagnetic media and in dielectric media with piezoelectric or ferromagnetic (with linear characteristic of magnetization) properties.

There are some works devoted to the issues of existence and propagation of waves in magnetoactive media in dependence on intensity of magnetic field and properties of the medium. The works [10,11] are devoted to the investigation of surface magnetoelastic waves with thermal relaxations, and in the work [9] the issues of existence of shear surface waves in magnetostrictive half-space (Blustein-Guliaev type wave) are studied. The issues of interaction between magnetic and acoustic waves in magnetoactive media are investigated in works [1,6]. The issues of existence and propagation of shear surface waves in piezomagnetic media are studied in [3]. In the works [4] the issues of reflection of shear magnetoelastic waves in magnetoactive media. It is discovered that when the volume wave falls on the edge of division between magnetoactive half-space and vacuum the qualitatively new vibrations (accompanying surface magnetoelastic vibrations) accompany the usual reflection process, which are conditioned exclusively by the magnetostrictive property of the medium. In the work [2] the linearized equations and boundary conditions are derived characterizing the behavior of small disturbances in non-conductive magnetoactive elastic media using non-linear equations and boundary conditions of the theory of magnetoelasticity of ferromagnetic bodies [1,2,5,6,8,13] and using the linearization technique [2,7,8]. Here on the basis of addressed in [3] linear boundary value problems by solving two-dimensional problems of wave dynamics, the character of propagation of plane volume waves depending on the magnetostrictive properties of the medium and its interaction with magnetic field is studied.

2. Basic equations and boundary conditions

Let an elastic dielectric media with the ordered magnetic structure is placed in an external stationary magnetic field, which in absence of a ferromagnetic body is characterized by the vector of intensity $\vec{H}_0$ and vector of a magnetic induction $\vec{B}_0 = \mu_0\vec{H}_0$ ($\mu_0 = 4\pi\cdot10^{-7}\,\text{H/A}^2$ is the magnetic constant). The surroundings of the body are considered as vacuum.

The paper [2] is devoted to issues of mathematical modeling of disturbed motion of considered magnetoelastic medium in the presence of an external magnetic field. In that paper, using the basic postulates of nonlinear theory of magnetoelasticity of ferromagnetic bodies [1,2,5,6,8,13] and the theory of small disturbances, via linearization technique [2,7,8] the following linear equations and surface conditions describing the behavior of small disturbances in the noted magnetoactive deformable media are obtained:

equation in internal area

$$\frac{\partial}{\partial x_i}\left(s_{ik} + s^0_{im}\frac{\partial u_k}{\partial x_m}\right) + \mu_0 M^0_i \frac{\partial h_k}{\partial x_i} + \mu_0 m_i \frac{\partial H^0_k}{\partial x_i} = \rho_0 \frac{\partial^2 u_k}{\partial t^2}$$

$$\operatorname{rot}\vec{h} = 0, \qquad \operatorname{div}\vec{b} = 0, \qquad \vec{b} = \mu_0\left(\vec{h} + \vec{m}\right) \tag{2.1}$$

$$s_{ij} = \bar{c}_{ijkl}\frac{\partial u_k}{\partial x_l} + \mu_0 e_{ijk} m_k$$

$$h_i = g_{ijk}\frac{\partial u_j}{\partial x_k} + A_{ik} m_k$$

where s_{ik} disturbances of components of the tensor of magnetoelastic stresses; s^0_{ik} are components of the tensor of stresses in unexcited shape; u_k are the disturbances of the vector of elastic displacements $\vec{u}^0$ of unexcited state; h_k, m_k and b_k are components of vectors $\vec{h}$, $\vec{m}$ and $\vec{b}$, which are disturbances according to the intensity $\vec{H}^0$, magnetization $\vec{M}^0$ and magnetic induction $\vec{B}^0$ of unexcited magnetic field, x_i are Cartesian coordinates;

equations in external area

$$\mathrm{rot}\vec{h}^{(e)} = 0, \quad \mathrm{div}\vec{h}^{(e)} = 0, \quad \vec{b}^{(e)} = \mu_0 \vec{h}^{(e)} \tag{2.2}$$

index "e" here and further means belonging to the external area;

boundary conditions on the surface S_0 of unexcited body:

$$\left[s_{ik} + s^0_{km}\frac{\partial u_i}{\partial x_m}\right]n^0_k = \left[t^{(e)}_{ki} - t_{ki}\right]n^0_k + \left[T^{0(e)}_{km} - T^0_{km}\right]\frac{\partial u_i}{\partial x_m}n^0_k$$

$$\left[b_k - b^{(e)}_k\right]n^0_k = \left[B^0_m - B^{0(e)}_m\right]\frac{\partial u_i}{\partial x_m}n^0_i \tag{2.3}$$

$$\varepsilon_{nmk}\left\{\left[h_n - h^{(e)}_n\right]n^0_m - \left[H^0_n - H^{0(e)}_n\right]\frac{\partial u_i}{\partial x_m}n^0_i\right\}$$

where T^0_{km} and $T^{0(e)}_{km}$ are Maxwell stress tensors of unexcited shape for a body and medium respectively (see (2.9)), n^0_k are components of the external unit vector $\vec{n}_0$ to the surface S_0, ε_{ijk} is the Livi-Civita's tensor.

$$\begin{aligned} t_{ki} &= b_k H^0_i + h_i H^0_k - \mu_0 \delta_{ki}\vec{H}^0\vec{h} \\ t^{(e)}_{ki} &= \mu_0\left[h^{(e)}_i H^{0(e)}_k + h^{(e)}_k H^{0(e)}_i - \delta_{ki}\vec{H}^{0(e)}\vec{h}^{(e)}\right] \end{aligned} \tag{2.4}$$

In the equations (2.1) the following notations are used.

$$\begin{aligned} \bar{c}_{ijkl} &= c_{ijkl} + \mu_0 A_{pq} M^0_r M^0_j\left(\delta_{ik}\delta_{pl}\delta_{rq} + \delta_{kl}\delta_{iq}\delta_{ir} + \delta_{lp}\delta_{iq}\delta_{kr}\right) + \\ &+ \frac{\mu_0}{2}B_{pqrs}\left(\delta_{ip}\delta_{jq}\delta_{kl} + \delta_{iq}\delta_{jk}\delta_{pl} + \delta_{ik}\delta_{jq}\delta_{pl}\right)M^0_r M^0_s + \\ &+ \mu_0 B_{pqrs}\left(\delta_{pk}\delta_{ql}\delta_{is}M^0_j + \delta_{ip}\delta_{jq}\delta_{ls}M^0_k\right)M^0_r \\ e_{ijk} &= B_{ijkl}M^0_l + A_{ml}\left(\delta_{kj}M^0_m + \delta_{mk}M^0_j\right) \\ g_{ijk} &= B_{jkpi}M^0_p + A_{rs}\left(\delta_{is}\delta_{jk}M^0_r + \delta_{rk}\delta_{is}M^0_j + \delta_{ij}\delta_{sk}M^0_r\right) \end{aligned} \tag{2.5}$$

where c_{ijkl}, A^{-1}_{kl} and B_{ijkl} are tensors of elastic constants, magnetic permeability and magnetostrictive constants, respectively.

For magnetoelastic bodies which in the non-magnetization shape are isotropic with respect both magnetic and elastic properties, the following equations are [2,12,13]:

$$\begin{aligned} c_{ijkl} &= \lambda\delta_{ij}\delta_{kl} + \mu\left(\delta_{ik}\delta_{jl} + \delta_{il}\delta_{jk}\right), \qquad A_{kl} = \chi^{-1}\delta_{kl} \\ B_{ijkl} &= e_2\delta_{ij}\delta_{kl} + \frac{1}{2}\left(e_1 - e_2\right)\left(\delta_{ik}\delta_{jl} + \delta_{il}\delta_{jk}\right) \end{aligned} \tag{2.6}$$

where λ and μ are Lame constants; χ is the magnetic permeability; e_1 and e_2 are magnetostrictive constants of the medium.

It is necessary to add to the equations (2.2) the conditions of attenuation of disturbances of magnetic quantities on infinity.

When considering the linearized equation and expressions (2.1) - (2.5) it is noticed, that into the coefficients of these expressions the quantities with superscript "0" are included, which in turn also non-linear and should be linearized. Details of the specified process of linearization are investigated in the work [8]. Here (in the work [2]) the simplified variant is applied based on identifications of geometry of an initial body in a non-excited state. By this assumption it is accepted, that a) the magnetic field of the unexcited shape coincides with a magnetic field of a non-deformable body and b) stresses and deformations of the unexcited shape can be defined from the solution of the following static problem of the theory of elasticity:

equations of equilibrium

$$\frac{\partial s_{ik}^0}{\partial x_k} + \mu_0 M_n^0 \frac{\partial H_k^0}{\partial x_n} = 0$$
$$s_{ij}^0 = c_{ijkl} \frac{\partial u_k^0}{\partial x_l} + \mu_0 A_{ik} M_j^0 M_k^0 + \frac{1}{2}\mu_0 B_{ijkl} M_k^0 M_l^0 \qquad (2.7)$$

conditions on a surface of a non-deformable body

$$s_{ik}^0 N_k^0 = \left[T_{ki}^{0(e)} - T_{ki}^0\right] n_k^0$$

where

$$T_{ki}^{0(e)} = H_i^0 B_k^0 - \frac{1}{2}\mu_0 \delta_{ik}\left[\vec{H}^0\right]^2$$
$$T_{ki}^{0(e)} = \mu_0 H_i^{0(e)} H_k^{0(e)} - \frac{1}{2}\mu_0 \delta_{ik}\left[\vec{H}^{0(e)}\right]^2 \qquad (2.9)$$

Included in (2.7) - (2.9) characteristics of the non-disturbed magnetic field, according to the accepted assumption are defined from the following problem of magnetostatics for a non-deformable body:

equations magnetostatics in the internal area

$$\mathrm{rot}\vec{H}^0 = 0, \qquad \mathrm{div}\vec{B}^0 = 0$$
$$\vec{B}^0 = \mu_0\left(\vec{H}^0 + \vec{M}^0\right), \quad H_k^0 = A_{kl} M_l^0 \qquad (2.10)$$

equations in the external area

$$\mathrm{rot}\vec{H}^{0(e)} = 0, \qquad \mathrm{div}\vec{H}^{0(e)} = 0$$
$$\vec{M}^{0(e)} = 0, \qquad \vec{B}^0 = \mu_0 \vec{H}^{0(e)} \qquad (2.11)$$

conditions on the surface

$$\left(\vec{B}^0 - \vec{B}^{0(e)}\right)\cdot \vec{n}_0 = 0, \quad \left(\vec{H}^0 - \vec{H}^{0(e)}\right)\times \vec{n}_0 = 0 \qquad (2.12)$$

and condition on infinity

$$\vec{H}^{0(e)} \to \vec{H}^{(e)} \text{ for } x_1^2 + x_2^2 + x_3^2 \to \infty \qquad (2.13)$$

Thus, the issues of investigation of behavior of disturbances of magnetoelastic quantities of some shape is reduced to the consequently solution of the following three tasks:

1. Definition of the characteristics of a magnetic field of a non-deformable body on the basis of equations (2.10) - (2.13);

2. Definition of magnetoelastic quantities of the unexcited shape on the basis of equations (2.7) - (2.9) with the use of the solution of the first task;

3. Investigation of behavior of magnetoelastic disturbances on the basis of equations (2.1) - (2.6) with the use of the solutions of first two tasks.

On the basis of the formulated above boundary value problems and results of works [3,4] we'll consider the propagation character as volume as well as surface plane waves depending on magnetostrictive properties of the medium and on the magnetoelastic interactions.

3. Propagation Character of Volume Plane Waves

Let us consider the propagation of a plane magnetoelastic wave in a boundless magnetostrictive dielectric medium assuming that the perturbations depend on one of the Cartesian coordinates only, say x_1 and the time t. We choose the orthogonal system x_1, x_2, x_3 in such a way, that the coordinate plane (x_1, x_2) coincides with the plane formed by the direction of the given magnetic field $\vec{H}$ and the direction $\vec{n}$ of the propagation of the plane wave (the axis $0x_1$ is parallel to the vector $\vec{n}$. Then in this coordinate system the external magnetic field will have the form $\vec{H}_0 = (H_{01}, H_{02}, 0)$, where $H_{0i} = \text{const}$.

Taking into account the above-stated from (2.1)-(2.6)we have the following equations relative to the components of the displacement vector $\vec{u}(u_1, u_2, u_3)$ and the vector of the induced magnetic field $\vec{h}(h_1, h_2, h_3)$, which describe perturbed state of the medium under consideration in the case of one-dimensional motions have the form:

$$a_{11}\frac{\partial^2 u_1}{\partial x_1^2} + a_{12}\frac{\partial^2 u_2}{\partial x_1^2} = \rho_0 \frac{\partial^2 u_1}{\partial t^2}$$
$$a_{21}\frac{\partial^2 u_1}{\partial x_1^2} + a_{22}\frac{\partial^2 u_2}{\partial x_1^2} = \rho_0 \frac{\partial^2 u_2}{\partial t^2} \qquad (3.1)$$
$$a_{33}\frac{\partial^2 u_3}{\partial x_1^2} = \rho_0 \frac{\partial^2 u_3}{\partial t^2}$$

$$h_1 = \frac{\chi}{\mu_r}\left[(\chi e_1 + 3)H_{01}\frac{\partial u_1}{\partial x_1} + (\chi e_2 + 1)H_{02}\frac{\partial u_2}{\partial x_1}\right] \qquad (3.2)$$
$$h_2 = 0, \ h_3 = 0$$

where

$$a_{11} = \lambda + 2\mu + \mu_0\chi^2\left\{\left[\frac{1}{\mu_r}(\chi e_1 + 3)^2 - \frac{1}{\chi}\left(\chi^2 e_1^2 + \frac{3}{2}\chi e_1 + 3\right)\right]H_{01}^2 + \right.$$
$$\left. + \frac{e_2}{2}\left[1 - \chi(e_1 - e_2)\right]H_{02}^2\right\}$$

$$a_{22} = \mu + \mu_0\chi^2\left\{\gamma H_{01}^2 + \left[e_1 - \frac{3}{2}e_2 + \frac{\chi e_2 + 1}{\mu_r}\left(1 - \frac{e_1 - e_2}{2}\right)\right]H_{02}^2\right\} \qquad (3.3)$$

$$a_{33} = \mu + \mu_0\chi^2\left(\gamma H_{01}^2 + \frac{1}{2}e_2 H_{02}^2\right)$$

$$a_{12} = \mu_0\chi^2\left[e_1 - \frac{a}{\chi}(\chi e_2 + 1) - \frac{e_2 - 1}{\mu_r}(\chi e_2 + 3)\right]H_{01}H_{02}$$

$$a_{21} = \mu_0\chi^2\left(e_1 - \frac{a}{\mu_r}(e_1 - 3) - \frac{a^2}{\chi}\right)H_{01}H_{02}$$

$$\gamma = \frac{1}{2}e_1 - \frac{a^2}{\chi}, \quad a = 1 + \chi\frac{e_1 - e_2}{2}$$

From (3.1) follows that the displacement u_3 is defined independently of u_1, u_2 in the boundless medium and the corresponding transversal waves are magnetostrictionally unbounded since they don't bring to the rise of induced magnetic field, as it is shown from (3.2).

Let

$$u_j = u_j^0 \exp\left[i(kx_1 - \omega t)\right] \qquad (j = 1,2,3) \tag{3.4}$$

be the solution of (3.1), which corresponds to the propagation of the plane bulk magnetoelastic wave with the frequency ω and wave number k.

Substituting (3.4) into the (3.1) we get a linear system of homogeneous algebraic equations with respect to the amplitudes u_i^0. Applying the condition of existence of non-trivial solution for the mentioned system, we get the formulas, which define the velocities c_i of the propagation of magnetostrictionally bounded waves:

$$c_i^2 = \frac{a_{11} + a_{22} + q_i}{2\rho_0}, \quad i = 1,2 \tag{3.5}$$

$$c_3^2 = \frac{a_{33}}{\rho_0}$$

The following notation is introduced in (3.5)

$$q_i = (-1)^{i+1}\left[(a_{11} - a_{22})^2 + 4a_{12}a_{21}\right]^{1/2} \tag{3.7}$$

Given equations and obtained relations easily imply that if the medium is non-ferromagnetic $\chi = 0$ or the external magnetic field is absent $(H_i = 0)$ then $c_1^2 = (\lambda + 2\mu)/\rho_0$, $c_2^2 = c_3^2 = \mu/\rho_0$ and the results are coincided with the famous results for the pure elastic plane waves. The analysis of the characteristic equation depending on the orientation of given magnetic field shows, that

a) If the magnetic field is parallel or perpendicular to the direction of propagation ($\vec{H} \parallel \vec{n}$ or $\vec{H} \perp \vec{n}$, where $\vec{n}$ - is the direction of propagation of the plane wave) then all three waves are propagated independently;

b) In the case of $\vec{H} \perp \vec{n}$ one of these waves with the velocity c_1 is pure longitudinal and the other two waves are pure transversal and propagated with different velocities $(c_2 \neq c_3)$;

c) In the case of $\vec{H} \parallel \vec{n}$ the velocities of transversal waves coincide $(c_2 = c_3)$ (as in the case of pure elastic plane waves), pure longitudinal magnetoelastic wave with the velocity c_1 and a pure transversal wave with the velocity c_2 are propagated in the media and the propagation velocities depend on the value of magnetic field induction.

In other cases (in the sense of direction of magnetic field) in the magnetostrictionally coupled waves the vector of displacement $\vec{u}$ is not perpendicular or parallel to the direction of propagation of waves.

However taking into consideration that for the basic magnetostrictive materials $\chi e_i^2 B_s^2/\mu_0\mu << 1$ (where the B_s is the induction saturation), we observe that the deflection of $\vec{u}$ from the direction $\vec{n}$ in the case of wave with the velocity c_1 and the deflection of $\vec{u}$ from the plain of front for in the case of wave with the velocity c_2 nonsignificant. For this reason the first wave can be called quasi-longitudinal and the second one - quasi-transversal.

Thus it is shown that there are three types of plane magnetoelastic waves which can be propagated in the magnetostrictive elastic medium: quasi-longitudinal magnetostrictionally coupled, quasi-transversal magnetostrictionally coupled and transversal uncoupled.

Numerical Results. In previous point we have investigated the influence of interaction between magnetic field and magnetostrictive media. In particular it was shown that the anisotropy caused by magnetic field can qualitatively change the character of wave field in magnetostrictive media. Here numerical calculations are made for certain materials with the purpose of revealing the quantitative influence of magnetic field on velocities of plane waves propagation. For calculations *Ferrit F-107* and *FerroNickel* $NiFe_2O_3$ are chosen. For these materials the physical and mechanical constants are taken from the monograph [12] and they are:

For *Ferrite F-107* -

$$\rho_0 = 5.26 * 10^3 \, kg/meter^3; \; \lambda = 1.02 * 10^{11} \, Newton/meter^2;$$

$$\mu = 0.66 * 10^{11} \, Newton/meter^2; \; \mu_r = 30; \; e_1 = 42.2; \; e_2 = -22.1.$$

For *FerroNickel* $NiFe_2O_3$ -

$$\rho_0 = 7.1 * 10^3 \, kg/meter^3; \; \lambda = 1.17 * 10^{11} \, Newton/meter^2;$$

$$\mu = 0.55 * 10^{11} \, Newton/meter^2; \; \mu_r = 32; \; e_1 = 124.2; \; e_2 = -62.1.$$

The results for the *Ferrite F-107* are brought in fig.1 and for the *FerroNickel* $NiFe_2O_3$ - in fig. 2. In the figure

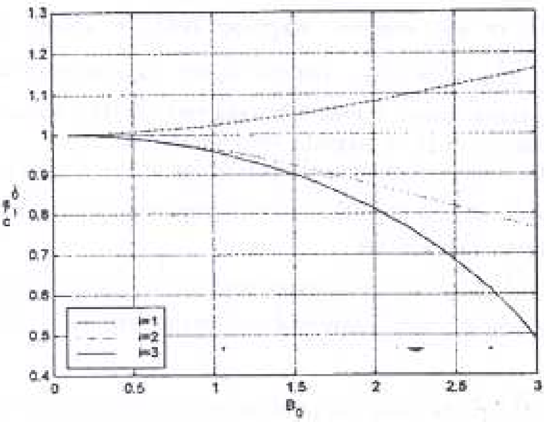

Fig. 1

Dependence of velocity of volume waves on magnetic induction for the Ferrite F-107

the dependence of c_i/c_{0i} on magnetic field induction are brought, when $B_{01} = \frac{1}{2} B_0$, $B_2 = \frac{\sqrt{3}}{2} B_0$. Here c_i, $i = 1,2,3$ - are velocities of propagation of magnetoelastic plane waves, which are defined from the formula $c_i^2 = \frac{a_{11} + a_{22} + q_i}{2\rho_0}$, $i = 1,2$; $c_3^2 = \frac{a_{33}}{\rho_0}$; and $c_{01}^2 = \frac{\lambda + 2\mu}{\rho_0}$ is the propagation velocity of longitudinal plane wave; $c_{02}^2 = c_{03}^2 = \frac{\mu}{\rho_0}$ are the propagation velocities of transversal plane waves in the absence of magnetic field.

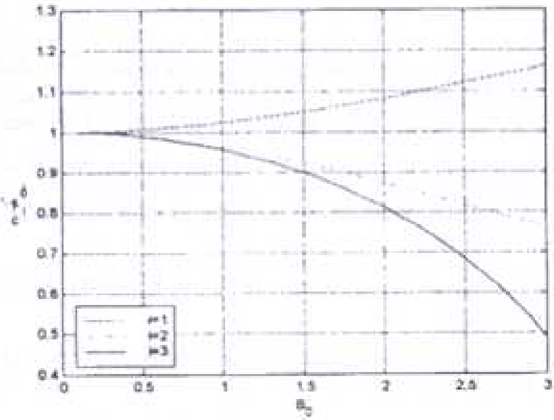

Fig. 2

Dependence of velocity of volume waves on magnetic induction for the FerroNickel F-107

From these figures it is easy to draw conclusions that:

1. With respect of magnetic field the velocity of transversal wave is more sensitive;
2. Depending on magnetic field value the velocity of longitudinal wave increases and the velocity of transversal wave decreases;
3. As it was shown in previous point the magnetic field influence is more essential for the materials having higher magnetostrictive constants.

4. Conclusions

A number of results and conclusions related to the character of propagation of volume plane waves in elastic dielectric magnetostrictive media in presence of constant magnetic field were made. It was shown that:

- there are three types of plane magnetoelastic volume waves, which can be propagated in the magnetostrictive elastic medium: quasi-longitudinal magnetostrictionally coupled, quasi-transversal magnetostrictionally coupled and transversal uncoupled;
- with respect to the magnetic field the velocity of transversal wave is more sensitive; depending on the magnitude of magnetic field the velocity of longitudinal wave increases and the velocity of transversal wave decreases.

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