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MAKSVELL TENGLAMASIDAN LAME KOEFFITSENTINI ANIQLASH MASALASI

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Annotatsiya. *Ushbu maqolada Integro-differensial Maksvell tenglamasi uchun Lame koeffitsiyentini aniqlashda teskari masalalarning qo‘yilishi haqida fikrlar yuritilgan.*

Kalit so‘zlar: *Maksvell tenglamasi, Lame, koeffitsiyent, teskari masala, teorema.*

Maksvell tenglamalar sistemasini qaraymiz [1], [2]:

$$\begin{cases} \frac{\partial E_2}{\partial t} - \frac{\partial H_1}{\partial x_3} + \sigma E_2 + \int_0^t \varphi_2(\tau) \frac{\partial}{\partial t} E_2(x_3, t-\tau) d\tau + J_2(x_3, t) = 0, \\ \mu \frac{\partial H_1}{\partial t} - \frac{\partial E_2}{\partial x_3} = 0 \end{cases} \quad (1)$$

Qulaylik uchun keying ishlarda $\varphi_2(t)$ funksiyani $\varphi(t)$ deb olamiz. Yangi o’zgaruvchi kiritib $E_2(y,t) = exp\left\{-\frac{\sigma+\varphi(0)}{2}t\right\}u(y,t),\ y \equiv x_3,$ $z = z(y) = \sqrt{\mu}y,$ $v(z,t) = u\left(\frac{z}{\sqrt{\mu}}, t\right)$ ba’zi almashtirishlardan so’ng (1) tenglamalar sistemasidan integro-differensial Maksvell tenglamasini olimiz:

$$\frac{\partial^2 v}{\partial t^2} - \frac{\partial^2 v}{\partial z^2} + q(z)v(z,t) = \int_0^t k(\tau)v(z,t-\tau)d\tau + F_1(z,t) \quad (2)$$

bunda $k(t) = exp\left\{-\frac{\sigma+\varphi(0)}{2}t\right\}\varphi''(t)$, $\Upsilon(y) = \varphi'(t)_{t=0} - \frac{(\sigma(y)+\varphi(0))^2}{4}$, $F(y,t) = exp\left\{\frac{\sigma+\varphi(0)}{2}t\right\}\frac{\partial}{\partial t}J_2(y,t), q(z) = \Upsilon\left(\frac{z}{\sqrt{\mu}}\right), F_1(z,t) = F\left(\frac{z}{\sqrt{\mu}}, t\right).$

Shunday qilib, biz integro - differensial Maksvell tenglamalar sistemasidan (1) ko’rinishdagi bir o’chamli ikkinchi tartibli integro - differensial tenglamani hosil qildik. Endi (2) integro - differensial Maksvell tenglamasi uchun teskari masalalarni qaraymiz.

$D := \{(z,t) |\ z \in R,\ t > 0\}$ sohada (2) integro – differensial tenglama uchun quyidagi Koshi masalasini qaraylik [3]:

$$v(z,t)|_{t=0} = \mu(z), \quad v_t(z,t)|_{t=0} = \nu(z). \quad (3)$$

Teskari masala. (2)- (3) masala yechimi va

$$v(z,t)|_{z=0} = f(t),\ v_z(z,t)|_{z=0} = g(t) \quad (4)$$

shartlar yordamida $q(z) \in C(R)$ funksiyani topish maslasiga teskari masala deyiladi.

Qo’shimcha berilgan shartlar uchun $f_1(t) \in C^2([z_0, t_0]),\ g(t) \in C^1([z_0, t_0])$ shartlar va quyidagi kelushuvchanlik sharti bajarilsin [4], [5]:

$$\mu(z_0) = f(0), \quad \mu'(z_0) = g(0), \nu(z_0) = f'(0), \quad \nu'(z_0) = g'(0). \quad (5)$$

Teorema. Berilgan funksiyalar $\mu(z) \in C^2[z_0 - t_0, z_0 + t_0]$, $k(t) \in C[0, t_0]$, $F_1(z, t)$, $\in C^{0,1}\big(D(z_0, t_0)\big)$, $\nu(z) \in C^1[z_0 - t_0, z_0 + t_0]$, $g(t) \in C^1([z_0, t_0])$ $f(t) \in C^2([z_0, t_0])$, sinflardan, $|\mu(z)| \geq \alpha > 0$, $z \in [z_0 - t_0, z_0 + t_0]$ shart va kelushuvchanlik sharti (5) bajarilsin. U holda yetarlicha kichik $h > 0$ soni uchun (2) – (4) teskari masalaning $[z_0 - h, z_0 + h]$ kesmadagi $C[z_0 - h, z_0 + h]$ sinfga tegishli $q(z)$ yechimi mavjud va yagona bo'ladi.

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