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The Cauchy problem for a system of moment e- elasticity theory existence sign of solution y

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Abstract : In this work, the problem of continuation of the solution of the system of equations of the theory of elasticity in the bounded special area in the part of the boundary according to its given values and values of its tension, that is, the Cauchy problem for the system of equations of the theory of elasticity, is studied, and the criterion of the existence of a solution of such problems is presented.

In this work, the ways of constructing suitable Karleman matrix in special flat fields are studied. In contrast to the previously considered construction of the Karleman matrix, the Karleman matrix was constructed independently, and the difference between the regularized solution and the exact solution was evaluated.

Keywords: *The Karleman matrix* has a regular solution

Enter. D elastic medium E^2 bounded at is a single link, the boundary $y_1 = 0$ of the real axis l piece and $y_2 > 0$ smooth lying in a half-plane S consist of a curve, i.e D cap-shaped area.

Let's test the following function

$$U_\sigma(x) = \int_S [\Pi(y,x,\sigma)\{T(\partial_y,n)U(y)\} - \{T(\partial_y,n)\Pi(y,x,\sigma)\}^* U(y)]ds_y . \quad (1)$$

As we know, in paragraph 2.2, the theorem in house q was valid .

Theorem 1 . *$U(x) -$ (18) of the system$D -$ let the regular solution in the field satisfy the following condition*

$$|U(y)| + |T(\partial_y,n)\,U(y)| \le M, \quad y \in \partial D \backslash S \quad (2)$$

In this case $\sigma \ge 1$ *too*

$$|U(y) - U_\sigma(y)| \le MC_2(x)\sigma \exp(-\sigma x_2) ,$$

inequality is relevant.

The result . *Theorem 1 –a two formulas in house q are equally strong when the conditions are met*

$$U(x) = \lim_{\sigma\to\infty} \int_S [\Pi(x,y,\sigma)\{T(\partial_y,n)U(y)\} - -\{T(\partial_y,n)\Pi(x,y,\sigma)\}^* U(y)]ds_y$$

$$U(x) = \int_S [\Pi(y,x)\{T(\partial_y,n)U(y)\} - -\{T(\partial_y,n)\Pi(y,x)\}U(y)]ds_y + \int_0^\infty \mathcal{R}(\sigma,x)d\sigma \quad (3)$$

This on the ground

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$$\mathcal{R}(\sigma,x)=\int_S [\Omega(y,x,\sigma)\{T(\partial_y,n)U(y)\}-$$
$$-\{T(\partial_y,n)\Omega(y,x,\sigma)\}U(y)]ds_y$$

$\Omega(y,x,\sigma)=\frac{\partial}{\partial\sigma}\Pi(y,x,\sigma)=\left\|\frac{\partial}{\partial\sigma}\Pi_{kj}(y,x,\sigma)\right\|$, $\Pi(y,x)$ *– using* $\Phi(y,x)=-\frac{i}{4}H_0^{(1)}(k|x|)$ *– the formula The Hankel function is a Karleman matrix constructed by* $\Pi(y\,,x)=\Gamma(y\,,x)+G(y\,,x)$

Proof. $\lim_{\sigma\to\infty}U_\sigma(x)=\int_0^\infty\frac{dU_\sigma(x)}{d\sigma}d\sigma+U_0(x).$

Now $U_\sigma(x)$ if we use the above expression of

$$u_0(x)=u_\sigma(x)|_{\sigma=0}=$$
$$=\int_S[P(y,x,0)\{T(\partial_y,n)u(y)\}-u(y)\{T(\partial_y,n)P(y,x,0)\}]ds_y\,.$$

$$\frac{dU_\sigma(x)}{d\sigma}=\frac{d}{d\sigma}\int_S[P(y,x,\sigma)\{T(\partial_y,n)u(y)\}-$$
$$-u(y)\{T(\partial_y,n)P(y,x,\sigma)\}]ds_y=$$
$$=\int_S\left[\frac{d}{d\sigma}P(y,x,\sigma)\{T(\partial_y,n)u(y)\}-\right.$$
$$\left.-u(y)\{T(\partial_y,n)\frac{d}{d\sigma}P(y,x,\sigma)\}\right]ds_y\,.$$

Let's define now $\Omega(y,x,\sigma)=\frac{\partial}{\partial\sigma}\Pi(y,x,\sigma)$

$$U(x)=\lim_{\sigma\to\infty}U_\sigma(x)=\int_0^\infty\frac{dU_\sigma(x)}{d\sigma}d\sigma+U_0(x)=$$
$$=\int_0^\infty\left\{\int_S\left[\frac{d}{d\sigma}P(y,x,\sigma)\{T(\partial_y,n)u(y)\}-\right.\right.$$
$$\left.\left.-u(y)\{T(\partial_y,n)\frac{d}{d\sigma}P(y,x,\sigma)\}\right]ds_y\right\}d\sigma+$$
$$+\int_S[P(y,x,0)\{T(\partial_y,n)u(y)\}-u(y)\{T(\partial_y,n)P(y,x,0)\}]ds_y=$$
$$=\int_0^\infty\left\{\int_S[\Omega(y,x,\sigma)\{T(\partial_y,n)U(y)\}-\right.$$
$$\left.-\{T(\partial_y,n)\Omega(y,x,\sigma)\}U(y)]ds_y\right\}d\sigma+$$
$$+\int_S[P(y,x,0)\{T(\partial_y,n)u(y)\}-u(y)\{T(\partial_y,n)P(y,x,0)\}]ds_y=$$

$$=\int_S [\Pi(y,x)\{T(\partial_y,n)U(y)\}-$$

$$-\{T(\partial_y,n)\Pi(y,x)\}U(y)]ds_y+\int_0^\infty \mathcal{R}(\sigma,x)d\sigma.$$

So the result proved.

Theorem $S\in C^2,\ f\in C^1(S),\ \ g\in C(S)$ **1** . *(1) in area D of the system*

$$U(y)=f(y),\ \ \mathrm{T}\left(\partial_y,n(y)\right)U(y)=g(y),\qquad y\in S_0,$$

satisfying the conditions $U(x)$ *to have a regular solution*

$$\left|\int_0^\infty \partial_x^p\mathcal{R}(\sigma,x)d\sigma\right|<\infty,\ \ |p|\le 2, \tag{4}$$

where p *−multiindex,* $S_0=S\backslash\{a,b\}$ *, is necessary and sufficient for the condition D to be flat in an arbitrary compact. If these conditions are met, the solution is determined using equivalent formulas.*

Proof. ***Necessity*** . in the field of the system D

$$\mathrm{U(y)=f(y),\ \ T}\left(\partial_y,\mathrm{n(y)}\right)\mathrm{U(y)=g(y)},\qquad \mathrm{y}\in \mathrm{S}_0,$$

satisfying the conditions$U(x)$ let there be a regular solution in which $f\in C^1(S),\ \ g\in C\ (S)\ \ \varepsilon>0$. we count $S_\varepsilon=S\backslash\ \{y\in R^3{:}\ y_3<\varepsilon\},$

$D_\varepsilon=D\backslash\{y\in R^3{:}\ y_3\le\varepsilon\}$ we will criticize the designations. D_ε the boundary of the field is S_ε a smooth line and ox lies on the axis l_ε consists of cross section. D_ε function in the field

$$\frac{\partial}{\partial\sigma}F_\sigma\ (y,x,k)=\frac{1}{-2\pi}\frac{\partial}{\partial\sigma}\int_0^\infty Im\frac{\exp\left(\sigma(w-x_2)\right)}{w-x_2}\frac{uJ_0(ku)du}{\sqrt{u^2+\alpha^2}}=$$

$$=\frac{1}{-2\pi}\int_0^\infty Im\frac{\exp\left(\sigma(w-x_2)\right)}{\sqrt{u^2+\alpha^2}}uJ_0(ku)du=$$

$$=\frac{1}{-2\pi}\int_0^\infty Im\frac{\exp\left(\sigma(w-x_2)\right)}{\sqrt{u^2+\alpha^2}}uJ_0(ku)du=$$

$$=\frac{exp(-\sigma x_2)}{2\pi}\int_0^\infty\frac{u}{\sqrt{u^2+\alpha^2}}sin\left(\sigma\sqrt{u^2+\alpha^2}\right)J_0(ku)du\ .$$

in this $w=i\sqrt{u^2+a^2}+y_2,\ \ \alpha=|y_1-x_1|,\ \alpha>0,$ y is regular in the entire plane, which means that $\frac{\partial}{\partial\sigma}\Pi(y,x,\sigma)$ all elements of the matrix are regular. If we evaluate the expressions formed by differentiation according to the definition of the Karleman matrix, we get the following$x$

$$\left|\partial_x^p\mathcal{R}_\varepsilon(\sigma,x)\right|\le\int_{S_\varepsilon}\left[\left|\Omega(y,x,\sigma)\right|+\left|\left\{T(\partial_y,n)\Omega(y,x,\sigma)\right\}\right|\right]\cdot$$

$$\cdot\left[|f(y)|+|g(y)|\right]ds_y\le$$

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$$\leq C(x)\sigma\exp(-\sigma x_2),\quad |p|\leq 2,\ \ x_2>0,$$

In this

$$C(x)=\mathrm{C}(\lambda,\mu)\int_0^\infty \frac{\sin\sqrt{u^2+\alpha^2}}{\sqrt{u^2+\alpha^2}}du\ .$$

Thus, $\varepsilon\to 0$ we pass from the last inequality to the limit

$$\left|\partial_x^p\mathcal{R}(\sigma,x)\right|\leq C(x)\sigma\exp(-\sigma x_2),\quad |p|\leq 2,\ \ x_2>0,$$

we will have . From this we get (3.4). The necessity has been proven.

Sufficiency . $S\ \in C^2,\ f\in C^1(S),\ \ g\in C(S)$ let the inequality be appropriate. We show that the system $U(x)$ has a regular solution such that

$$U(y)=f(y),T\left(\partial_y,n(y)\right)U(y)=g(y),y\in S_0\ .$$

$$U(x)=\lim_{\sigma\to\infty}\int_S\left[\Pi(x,y,\sigma)\{T(\partial_y,n)U(y)\}-\right.$$
$$\left.-\{T(\partial_y,n)\Pi(x,y,\sigma)\}^*U(y)\right]ds_y \tag{5}$$

$$U(x)=\int_S[\Pi(y,x)\{T(\partial_y,n)U(y)\}-$$
$$-\{T(\partial_y,n)\Pi(y,x)\}U(y)]ds_y+\int_0^\infty\mathcal{R}(\sigma,x)d\sigma \tag{3.2}$$

$$\mathcal{R}(\sigma,x)=\int_S[\Omega(y,x,\sigma)\{T(\partial_y,n)U(y)\}-$$
$$-\{T(\partial_y,n)\Omega(y,x,\sigma)\}U(y)]ds_y \tag{3.3}$$

$$\left|\int_0^\infty\partial_x^p\mathcal{R}(\sigma,x)d\sigma\right|<\infty,\ \ |p|\leq 2, \tag{3.4}$$

Satisfies the condition. We consider the function defined by equivalent formulas (5) and (3.2) $U(x)$. ($R_+^3\backslash\bar{D}$ 3.2) D represents the two regular solutions of the system (1) on the right-hand side of the equation and $y\in S_0$ the two symmetric points on the y normal to the point ($x^{(1)},x^{(2)}$) both internally and

also by externally symmetric points $y\in S_0$and the difference of their voltages $g(y)$ is equal $f(y)$ to . Moreover, if one of these functions S_0 is continuous in its domain, then the other one will have the same property. According to (3.4), the second addendum of equality (3.2) R_+^2 is a regular solution of system (1). Thus, the right-hand side of the equation (3.2) $U_1(x)$ consists of two regular solutions in the fields and , respectively, for which $y\in S_0$ the $U_2(x)$ following $R_+^3\backslash\bar{D}$ relation D holds at the point

$$\begin{cases}U_1^+(y)-U_2^-(y)=f(y)\\ T(\partial_y,n)U_1^+(y)-T(\partial_y,n)U_2^-(y)=g(y)\,,\end{cases} \tag{3.5}$$

moreover, if one of these functions $S_0$is continuous in its domain, then the other will have the same property. It can also be seen from formula (3.1). $U_2(x)=0$, $x\in\{x\in R^2\colon x_2>\sup\{y_2\colon y\in\bar{D}\}$ .In this case, according to the uniqueness theorem (because the regular solutions of elliptic systems are analytic) $U_2(x) \equiv 0,\ x \in R_+^3 \backslash \bar{D}$. Now it is seen from (3.5) that the proof of the theorem is fulfilled. The theorem was proved.

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