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Nolocal Problems In Half-Selected Half For Equipment

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Annotation: This article explores the non-zero conditional problem for the elliptic type equation. The uniqueness of the solution to the problem is proved by the principle of Zarembo-Jiro, and the existence of a solution is proved by the use of a Drixle problem.
Keywords: the decomposition equation, the zero problem, the Zarembo-Jiro principle, the Drixle problem.

I. Issue. $\Omega=\{(x,y):-\infty<x<+\infty,\ y>0\}$ Let us look at this perturbed differential equation of the elliptical type in the

$$y^m u_{xx}+u_{yy}=0,\quad m=const>0. \tag{1}$$

Ω of the sector $S=\{(x,y):-\infty<x<+\infty,\ y=0\}$ subdivide three he border

$$l_0=\{(x,y):-1<x<1,\ y=0\},\ l_1=\{(x,y):-\infty<x<-1,\ y=0\},$$
$$l_2=\{(x,y):1<x<+\infty, y=0\}$$

Now, make notes. I mean, $S=l_1\cup\overline{l_0}\cup l_2$.

The issue. Thus $u(x,y)\in C(\Omega\cup S)\cap C^2(\Omega)$ find the function, it Ω in the sector (1) is the regular solution of the equation,

$$u_{xx}(x,y),\ u_y(x,y)\in C(\Omega\cup l_0); \tag{2}$$

$$u_{xx}(x,y)+a(x)u_x(x,y)+b(x)u(x,y)+u_y(x,y)=c(x),\ (x,y)\in l_0; \tag{3}$$

$$u(x,y)=\varphi_1(x),\ (x,y)\in l_1;\ u(x,y)=\varphi_2(x),\ (x,y)\in l_2; \tag{4}$$

$$\lim_{R\to-\infty}u(x,y)=0,\quad y\ge 0 \tag{5}$$

satisfy the conditions, here $\varphi_1(x),\varphi_2(x),a(x),b(x),c(x)-$ given continuous functions, $\lim_{x\to-\infty}\varphi_1(x)=0,\ \lim_{x\to-\infty}\varphi_2(x)=0,\ b(x)<0;\ R=\sqrt{x^2+y^2}$.

We will prove that the solution to this problem is unique. In this

$$u(x,0)=\tau(x),\ -1\le x\le 1;\ u_y(x,0)=\nu(x),-1<x<1 \tag{6}$$

we use markings.

II. Unity of solution. Imagine that $u_1(x,y)$ va $u_2(x,y)$ have solutions. In that case $u_1(x,y)-u_2(x,y)=u(x,y)$ function Ω in the field (1) is the regular solution of the equation, (2), (5) and

$$u(x,y)\equiv 0,\ (x,y)\in l_1\cup l_2; \qquad (4')$$

$$\tau''(x)+a(x)\tau'(x)+b(x)\tau(x)+\nu(x)=0,\ x\in(-1,1) \qquad (3')$$

satisfies the conditions.

Imagine that, $u(x,y)\not\equiv 0,\ x\in\Omega\cup S.$ Then it is $\Omega_r=\{(x,y):|x^2+y^2|\le r^2,\ y>0\}$ There is a sector (here $r=const>0$) that $u(x,y)\not\equiv 0$. that is why

$$\sup_{\bar{\Omega}_r}|u(x,y)|=|u(x_0,y_0)|>0,\ (x_0,y_0)\in\bar{\Omega}_r.$$

Based on the principle of extremity for elliptic type equations $(x_0,y_0)\notin\Omega_r$. $(4')$ subject to condition $(x_0,y_0)\notin l_1\cup l_2$. Accordingly, $(x_0,y_0)\in l_0$, namely $(x_0,y_0)=(x_0,0)$, $-1<x<1$. In that x_0 at the point $\tau(x)$ the function reaches a positive maximum or a negative maximum. That is why $\tau(x_0)>0(<0)$ when $\tau''(x_0)\le 0\,(\ge 0)$, $\tau'(x_0)=0$ that's it,

$$\tau''(x_0)+a(x_0)\tau'(x_0)+b(x_0)\tau(x_0)+\nu(x)=0$$

from equality $\nu(x_0)>0(<0)$ resulting inequality. This is contrary to the Zarembo-Jiro principle. So $(x_0,y_0)\notin l_0$.

In that case, that is

$$\sup_{\bar{\Omega}_r}|u(x,y)|=\sup_{S_r}|u(x_0,y_0)|>0. \qquad (7)$$

Now $\forall R>r$ get the numbers and consider the above Ω_R in the field,

$$\sup_{\bar{\Omega}_r}|u(x,y)|=\sup_{S_r}|u(x,y)|>0 \qquad (8)$$

We have a relationship. $\bar{\Omega}_R\supset\bar{\Omega}_r$ because of this

$$\sup_{\bar{\Omega}_R}|u(x,y)|\ge\sup_{\bar{\Omega}_r}|u(x,y)|.$$

In that case (7) and (8) based on inequalities

$$\sup_{\bar{S}_R}|u(x,y)|\ge\sup_{\bar{S}_r}|u(x,y)|>0$$

the inequalities are relevant. This is contrary to condition (5). This contradiction leads to the conclusion that our hypothesis is wrong $u(x,y)\equiv 0,\ (x,y)\in\Omega\cup S$. So, $u_1(x,y)\equiv u_2(x,y),\ (x,y)\in\Omega\cup S$.

III. Availability of a solution. The solution of the problem Ω in the sphere (1) as the solution of the Dirixle problem for equation

$$u(x,y)=k_2 y\int_{-\infty}^{+\infty}u(t,0)\left[(x-t)^2+\frac{4}{(m+2)^2}y^{m+2}\right]^{\beta-1}dt \tag{9}$$

Search like. (9) da $x\in(-1,1)$ va $y>0$ that's it y differentiate. In this

$$\frac{\partial}{\partial y}\left\{y\left[(x-t)^2+\frac{4}{(m+2)^2}y^{m+2}\right]^{\beta-1}\right\}=$$

$$=\frac{1}{\beta-1}\frac{\partial}{\partial x}\left\{(x-t)\left[(x-t)^2+\frac{4}{(m+2)^2}y^{m+2}\right]^{\beta-1}\right\}dx$$

Taking into account the equality, then zero and (6)

$$v(x)=\frac{k_2}{2\beta-1}\left[\frac{d}{dx}\int_{-\infty}^{+\infty}(x-t)|x-t|^{2\beta-2}u(t,0)\right]dt$$

based on equality, or (4) terms and (6)

$$v(x)=\frac{k_2}{2\beta-1}\frac{d}{dx}\int_{-1}^{1}(x-t)|x-t|^{2\beta-2}\tau(t)dt+f(x) \tag{10}$$

Here we go equality

$$f(x)=\frac{k_2}{2\beta-1}\frac{d}{dx}\int_{-\infty}^{-1}(x-t)^{2\beta-1}\varphi_1(t)dt-\frac{k_2}{2\beta-1}\frac{d}{dx}\int_{1}^{+\infty}(t-x)^{2\beta-1}\varphi_2(t)dt=$$

$$=k_2\int_{-\infty}^{-1}(x-t)^{2\beta-2}\varphi_1(t)dt+k_2\int_{1}^{+\infty}(t-x)^{2\beta-2}\varphi_2(t)dt \tag{11}$$

Using the fractional order differential sign in Eq

$$v(x)=-k_2\tilde{A}(1-2\beta)\left[D_{-1x}^{1-2\beta}\tau(x)+D_{x1}^{1-2\beta}\tau(x)\right]+f(x) \tag{12}$$

written in the form.

(11) equation, $f(x)$ so that the function is continuous $\varphi_1(x)=(1+x)^{1-2\beta+\varepsilon}$, $\varphi_2(x)=(1-x)^{1-2\beta+\varepsilon}$ It should be, here $\varepsilon>0$ and (11) subject to equation (11)

$$\tau''(x)=a(x)\tau'(x)+b(x)\tau(x)-k_2\tilde{A}(1-2\beta)\times$$
$$\times\left[D_{-1x}^{1-2\beta}\tau(x)+D_{x1}^{1-2\beta}\tau(x)\right]=c(x)-f(x) \qquad (13)$$

differential equation.

(4) and from the boundary conditions

$$\tau(-1)=0,\ \ \tau(1)=0 \qquad (14)$$

equations arise.

Ergo, $\tau(x)-$ function $\{(13),(14)\}$ as the solution. $\tau(x)$ Once the problem is found, the solution to this problem is determined by (1).

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