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THE BOUNDARY VALUE PROBLEM FOR EQUATION OF A MOBILE SECOND KIND TYPE WITH OFFSET

Abraev B.X.
The Termiz state of university.

Gulmirzayeva S.M
Termiz state of university.

Tilavov I.A.
The Termiz state of university.

ABSTRACT

At the current an article take from functional a raho

KEY WORDS: Equation, curved, field, sphere, half-plane, characterize, the affixes, parabolic, degeneration, intersect, stick.

1. The setting task. Consider the equation

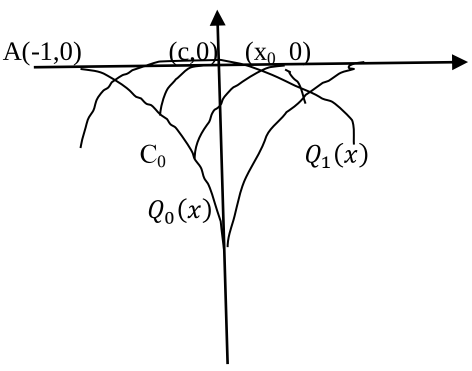
$$U_{xx} + signy|y|^m U_{yy} + \alpha|y|^{m-1}U_y = 0 \quad (0 < m < 2) \qquad (1)$$

Where, $(\alpha = const)$ $m-1 < \alpha < 1$ – constantly in a simple connected D bounded by a smooth curve G with ends at the points A(-1,0) and B(1,0) located in the half-plane y>0 and characteristics.

$AC; x - \frac{2}{2-m}(-y)^{\frac{2-m}{2}} = -1$ $BC: x + \frac{2}{2-m}(-y)^{\frac{2-m}{2}} = 1$ equation (1). We introduce following notations:

$$Q_0(x) = \frac{x_0-1}{2} - i\left[\frac{2-m}{4}(x_0+1)\right]^{\frac{2}{2-m}}$$

B(1,0)



$$Q_1(x) = \frac{x_0+1}{2} - i\left[\frac{2-m}{4}(1-x_0)\right]^{\frac{2}{2-m}}$$

where $Q_0(x)$ и $Q_1(x)$ are the affixes on the points of interection of the characteristcs of equation (1), from the points $x_0\epsilon(-1;1)$, with the characteristcs of AC and BC respectively.

Task. Finding the function of U(x, y), having next to characters:

1). $U(x;y) \in C(\overline{D})$

2). $U(x;y)$ – constant solution of the equation (1) at field D^+

3). $U(x;y)$ – generalize solution of the equation (1) of class of R_2 at field D^-

4). On line y=0 parabolic degeneration of the equations (1) are doing conditions sticks

$$U(x,+0) = U(x,-0)\ , \qquad -1 \le x \le 1$$

$$\nu(x) = \lim_{y\to -0}(-y)^{\alpha}\frac{\partial U}{\partial y} = -\lim_{y\to +0} y^{\alpha}\frac{\partial U}{\partial y} \qquad -1 \le x \le 1 \qquad (2)$$

5) $U(x;y)$ satisfies boundary conditions. $U|_{\Gamma} = \varphi(s)$ $s \in \Gamma$ $u|_{AC_0} = \psi(x)$ (3)

$U[Q_0(x)] + \mu U[Q_1(x)] = \rho(x)$ $(-1 \le x \le 1)$ (4)

where $\mu = const \ne 0$, $\rho(x)$ - continuous has piecewise continuous first order derivatue on the segment $[-1,1]$. [1]

2. Functional relationship between $\mathrm{T}(x)$ and $\nu(x)$.

In the half-plane $y < 0$ the equation accepts view.

$$U_{xx} - (-y)^m U_{yy} + \alpha(-y)^{m-1}U_y = 0$$

It can find by means of characteristic coordinates

$\xi = x - \frac{2}{2-m}(-y)^{\frac{2-m}{2}}$, $\eta = x + \frac{2}{2-m}(-y)^{\frac{2-m}{2}}$ it is converted to the Eyler-Darbu equation:

$$\frac{\partial^2 u}{\partial\xi\partial\eta} - \frac{\beta}{\eta-\xi}\left(\frac{\partial u}{\partial\eta} - \frac{\partial u}{\partial\xi}\right) = 0 \qquad [1] \qquad (5)$$

where $\beta = \frac{2\alpha-m}{2(2-m)}$, $\frac{1}{2} < \beta < 0$ so $m-1 < \alpha < \frac{m}{2}$ (6)

It is known that generalize solution $U(x;y)\,\epsilon R_2$ equations (5) satisfying the initial date. ([1])

$$U(x;0) = \tau(x)$$

$$\nu(x) = \lim_{y\to -0}(-y)^{\alpha}\frac{\partial u}{\partial y} = \left(\frac{2-m}{2}\right)^{2\beta}\lim_{\eta-\xi\to 0}(\eta-\xi)^{2\beta}\left(\frac{\partial u}{\partial\xi} - \frac{\partial u}{\partial\eta}\right) \quad -1 < x < 1$$

has the from $U(\xi,\eta) = \int_{-1}^{\xi}(\eta-t)^{-\beta}(t-\xi)^{-\beta}T(t)dt + \frac{1}{2cos\pi\beta}\int_{\xi}^{\eta}(\eta-t)^{-\beta}(t-\xi)^{-\beta}T(t)dt - \chi_2\int_{\xi}^{\eta}(\eta-t)^{-\beta}(t-\xi)^{-\beta}\nu(t)dt$ (7)

where $\chi_2 = \frac{\Gamma(2-2\beta)}{(1-\alpha)\Gamma^2(1-\beta)}\left(\frac{2-m}{4}\right)^{1-2\beta}$ (8)

$$\tau(x) = \tau(-1) + \int_{-1}^{x}(x-t)^{-2\beta}\mathrm{T}(t)dt \qquad (9)$$

Without loss of generality, we assume $\tau(-1) = 0$

From solution (7) we have

$$u[Q_1(x)] = \int_{-1}^{c}(x-t)^{-\beta}(c-t)^{-\beta}\mathrm{T}(t)dt + \frac{1}{2cos\pi\beta}\int_{-1}^{x}(x-t)^{-\beta}(t+1)^{-\beta}T(t)dt - -\chi_2\int_{-1}^{x}(x-t)^{-\beta}(t+1)^{-\beta}\nu(t)dt =$$
$$\Gamma(1-\beta)D_{-1,c}^{\beta-1}(c-x)^{-\beta}T(x) + \frac{\Gamma(1-\beta)}{2cos\pi\beta}D_{c,x}^{\beta-1}(x-c)^{-\beta}T(x) - \chi_2\Gamma(1-\beta)D_{c,x}^{\beta-1}(x-c)^{-\beta}\nu(x)$$

at $c=-1$, $Q_1(x)=Q_0(x)$ as well as

$$u[Q_0(x)]=\frac{\Gamma(1-\beta)}{2cos\pi\beta}D_{-1,x}^{\beta-1}(x+1)^{-\beta}T(x)-\chi_2\Gamma(1-\beta)D_{-1,x}^{\beta-1}(x+1)^{-\beta}\nu(x)$$

On the boundary condition (4) we use operator $D_{c,x}^{1-\beta}$ and obtain.

$$D_{c,x}^{1-\beta}u[Q_0(x)]+\mu D_{c,x}^{1-\beta}u[Q_1(x)]+D_{c,x}^{1-\beta}\rho(x)$$

$$D_{c,x}^{1-\beta}u[Q_0(x)]=$$

$$=\frac{d}{dx}\left[\frac{1}{\Gamma(\beta)}\int_c^x\frac{u[Q_0(t)]}{(x-t)^{1-\beta}}dt+\frac{1}{\Gamma(\beta)}\int_{-1}^c\frac{u[Q_0(t)]}{(x-t)^{1-\beta}}dt-\frac{1}{\Gamma(\beta)}\int_{-1}^c\frac{u[Q_0(t)]}{(x-t)^{1-\beta}}dt\right]$$

$$= \qquad =D_{-1,x}^{1-\beta}u[Q_0(x)]-\frac{d}{dx}\frac{1}{\Gamma(\beta)}\int_{-1}^c\frac{u[Q_0(t)]}{(x-t)^{1-\beta}}dt$$

Use of equality from this

$$D_{-1,x}^{1-\beta}u[Q_0(x)]=\mu\, D_{c,x}^{1-\beta}u[Q_1(x)]+\rho_1(\mathrm{x}) \qquad (10)$$

where $\rho_1(\mathrm{x})=D_{c,x}^{1-\beta}\rho(\mathrm{x})+\frac{d}{dx}\frac{1}{\Gamma(\beta)}\int_{-1}^c\frac{u[Q_0(t)]}{(x-t)^{1-\beta}}dt$ [2]

Now, we count

$$D_{c,x}^{1-\beta}u[Q_1(x)]=D_{c,x}^{1-\beta}\left\{\Gamma(1-\beta)D_{-1,c}^{\beta-1}(c-x)^{-\beta}T(x)+\frac{\Gamma(1-\beta)}{2cos\pi\beta}D_{c,x}^{\beta-1}(x-c)^{-\beta}T(x)-\chi_2\Gamma(1-\beta)D_{c,x}^{\beta-1}(x-c)^{-\beta}\nu(x)\right\}=\Gamma(1-\beta)D_{c,x}^{1-\beta}D_{-1,c}^{\beta-1}(c-x)^{-\beta}T(x)+\frac{\Gamma(1-\beta)}{2cos\pi\beta}(x-c)^{-\beta}T(x)-\chi_2\Gamma(1-\beta)(x-c)^{-\beta}\nu(x)$$

These equality boundary condition (10)

$$D_{-1,x}^{1-\beta}\left\{\frac{\Gamma(1-\beta)}{2cos\pi\beta}D_{-1,c}^{\beta-1}(\mathrm{x}+1)^{-\beta}T(x)-\chi_2\Gamma(1-\beta)D_{-1,c}^{\beta-1}(\mathrm{x}+1)^{-\beta}\nu(x)\right\}=\frac{\Gamma(1-\beta)}{2cos\pi\beta}(\mathrm{x}+1)^{-\beta}T(x)-\chi_2\Gamma(1-\beta)(\mathrm{x}+1)^{-\beta}\nu(x)$$

From here

$$\frac{\Gamma(1-\beta)}{2cos\pi\beta}(\mathrm{x}+1)^{-\beta}T(x)-\chi_2\Gamma(1-\beta)(\mathrm{x}+1)^{-\beta}\nu(x)=\mu\Gamma(1--\beta)D_{c,x}^{1-\beta}D_{-1,c}^{\beta-1}(c-x)^{-\beta}T(x)+\mu\frac{\Gamma(1-\beta)}{2cos\pi\beta}(x-c)^{-\beta}T(x)-\chi_2\mu\Gamma(1-\ \beta)(x-c)^{-\beta}\nu(x)++\rho_1(\mathrm{x})$$

We carry out don't be complex transformations and will find

$$\nu(x)=\frac{\mathrm{T(x)}}{2\chi_2\mathrm{cos}\pi\beta}-\mu\theta(\mathrm{x})+\rho_2(\mathrm{x}) \qquad (11)$$

Where $\omega(\mathrm{x})=\frac{(\mathrm{x}+1)^{-\beta}-\mu(\mathrm{x}-\mathrm{c})^{-\beta}}{(\mathrm{x}+1)^{\beta}(\mathrm{x}-\mathrm{c})^{\beta}}$, $\theta(\mathrm{x})=\frac{\mu}{\omega(\mathrm{x})}D_{c,x}^{1-\beta}(c-\ x)^{-\beta}D_{-1,c}^{\beta-1}T(x)$

$$\rho_2(\mathrm{x})=\frac{\rho_1(\mathrm{x})}{\omega(\mathrm{x})\Gamma(1-\beta)}$$

Formula (11) gives the first functional relation between $\mathrm{T}(x)$ and $\nu(x)$, which is determined from the condition that the $U(x;y)$ of equation (1) of the domen D^- must satisfy the boundary condition (4).

THE LIST OF LITERATURE

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