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Regularization of the Solution of the Question of Koshi in Accordance with the Laplas Equation

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Annotation: This article shows the correctness of the regularization of the Koshi problem put into the Laplas equation, shows the stagnation and regularization of the solution of the issue .

Keywords: Continuation of analogy, correctness, stagnation, regulary, Komplex plane, Koshi integral, Carleman function, Laplas equation.

Stability of the solution to the issue of analytical continuation.

Many practical issues are brought to the issue of analytical continuation. We note that in this paragraph one argument is the value in the field based on the value in the section of the boundary of the analytical function.

f(z) through this function Komplex plane is a regulyar and analytical in the field D, as well as continuous in $\overline{D}$

$|f(z)| \leq C \quad (z \in D)$ (1.1)

We define a function that satisfies the condition.

If $\Gamma = \partial D$ than, Γ_1 va Γ_2 and Γ let's take the parts, $\Gamma_1 \cup \Gamma_2 = \Gamma, \Gamma_1 \cap \Gamma_2 = \emptyset$.

If the values of f(z) are given in Γ_1, then to determine the values of f(z) in Z∈d basically we call the F(z) function the issue of analytical continuation from Γ_1_to D. In the case of $\Gamma_1 = \Gamma$, the solution of this issue is given by the following Koshi integrals, based on the theory ofeksex functions.

$$f(z) = \frac{1}{2\pi i}\int_{\Gamma} \frac{f(\xi)}{\xi - z} d\xi$$

1-theorem. If the function f(z) is a continuous function in the analytic D in the regulyar and D in the function D (1) satisfies the condition, and also inΓ_1

$$|f(z)| \leq \varepsilon \tag{1.2}$$

if the inequality is reasonable, then for each z∈D

$$|f(z)| \leq C^{1-\omega(z)} e^{\omega(z)} \tag{1.3}$$

Proof. φ(z)=ln|f (z)| we look at the function. φ(z) is a harmonic function, and f(z)≠0 is a regulyar at Z∈d points, which will be z∈D

If, $z_0 \in D$, in $f(z_0)$then

$\varphi(z) \to -\infty$, if $z \to z_0$ (1.4)

From (1.1) and (1.2)

$$\varphi(z) \leq ln\varepsilon, \text{ if } z \in \Gamma_1,$$
$$\varphi(z) \leq lnC, \text{ if } z \in \Gamma_2 \quad (1.5)$$

we will have inequalities.

through ψ (z) we define the following function

$\psi(z) = \omega(z)ln\varepsilon + [1 - \omega(z)]lnC.$

(4), (5),according to φ(z)≤ψ (z) inequality is appropriate.

As a result of this inequality

$$|f(z)| \leq C^{1-\omega(z)}e^{\omega(z)}$$

inequality arises. This inequality is called inequality, which assesses the stagnation of the solution of the analytical continuum.

Now we show that the solution of the Koshi problem put in the Laplas equation with the analytical continuation is equally strong.

Let u(z) harmonic and its derivative values are given in g_1. f (z) through the function u (z) and its harmonic addition ϑ(z) from the function f(z)=u(z)+iϑ (z), (z=x+iy) we define the visible function. ϑ(z)function if z_0 Γ_1 is one of the edge points of the line

$$\vartheta(z) = \int_{z_0}^{z} \frac{\partial}{\partial n} u(z)ds + C_1$$

Determined by the Formula. . From the analyticality of the function f(z), which is apparently determined, we can assume that on the line $\Gamma_1$the values of the analytical function f(z) are composed mainly of u and $\frac{\partial u}{\partial n}$

If $f(z) = u(z) + i\vartheta(z)$on Γ_1 is given the values of the analytical function, then from the Koshi-Riman condition

$$\left.\frac{\partial u}{\partial n}\right|_{\Gamma_1} = \left.\frac{\partial \vartheta}{\partial s}\right|_{\Gamma_1}$$

we find equality. where $\frac{\partial \vartheta}{\partial s}$ ϑ is the product of the function th on the length of the arc over Γ_1. Taking the derivatives of the functions f (z) and (f (z))¯at Γ_1

$$\left.\frac{\partial u}{\partial n}\right|_{\Gamma_1} = \frac{1}{2}\frac{\partial}{\partial s}(f - \bar{f})|_{\Gamma_1}$$

we find equality. Thus, the problem of analytical continuation of the function f (z) when $\Gamma_1 \neq \Gamma$ is reduced to the Cauchy problem for the equation $\Delta u = 0$. Therefore, the question of analytical continuation is not classically correct.

The uniqueness of the issue of analytical continuation is proved in the theory of komplek functions. It follows from the Koshi formula (1.1) that inequality is a conditional correction of the issue given that the set of satisfactory functions is compact.

Now we look at the function of Carleman in order to establish the regularization of the solution of the problem of analytical continuation.

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We can say that the sphere D and the Carleman function of the line are two Komplex and the function $G(z,\xi,\alpha)$ of one real variable,

1) $G(z,\xi,\alpha)=\frac{1}{\xi-z}+\tilde{G}(z,\xi,\alpha)$,

where is the analytical function of $\tilde{G}(z,\xi,\alpha)$- ξ and D is a regular and bounded function.

The function $G(z,\xi,\alpha)$satisfies the inequality $\int_{\Gamma_2}\left||G(z,\xi,\alpha)|\cdot d\xi\right|\leq\alpha$

For each $\varphi(z)$ we introduce a family of operators that match Γ_1 $\varphi_\alpha(z)$as follows,

$$\varphi_\alpha(\xi)=\int_{\Gamma_1}G(z,\zeta,\alpha)f(\zeta)d\zeta$$

Such a family of identified operators will be the regulating operator for the analytical continuation problem.

And

$$\int_{\Gamma_1}\bar{G}(z,\zeta,\alpha)f(\zeta)d\zeta=0$$

Because

$$f(z)=\frac{1}{2\pi i}\int_{\Gamma_1}G(z,\zeta,\alpha)f(\zeta)d\zeta+\frac{1}{2\pi i}\int_{\Gamma_1}G(z,\zeta,\alpha)f(\zeta)d\zeta$$

From the definition of the Carleman function, (2.1) tends to zero when the second term a → 0.

This is the second definition of the regulatory family. Let us now consider the effectiveness of the application of the regulation family to find an approximate solution based on the approximate data.

Given the approximate value of f (z) on the line Γ_1, let $f_\varepsilon(z)$

$$|f_\varepsilon(z)-f(z)|\leq\varepsilon,\quad z\in\Gamma_1$$

$f_{\alpha\varepsilon}(z)$ function

$$f_{\alpha\varepsilon}(z)=\frac{1}{2\pi i}\int_{\Gamma_1}G(z,\zeta,\alpha)f(\zeta)d\zeta$$

We take the condition and estimate the difference $f(z)-f_{\varepsilon\alpha}(z)$

$$f(z)-f_{\varepsilon\alpha}(z)=\frac{1}{2\pi i}\int_{\Gamma_2}G(z,\zeta,\alpha)f_\varepsilon(\zeta)d\zeta+\frac{1}{2\pi i}\int_{\Gamma_1}G(z,\zeta,\alpha)[f(\zeta)-f_\varepsilon(\zeta)]d\zeta$$

Based on the inequality from (2.1) and the Carleman function

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$$\int_{\Gamma_2} G(z,\zeta,\alpha) f_\varepsilon(\zeta) d\zeta \leq C\alpha \qquad (2.2)$$

we create an inequality.

We enter the following definitions

$$\mu(z,\alpha) = \int_{\Gamma_1} |G(z,\zeta,\alpha)||f(\zeta)|$$

(2.2) to the base

$$\left| \int_{\Gamma_1} G(z,\zeta,\alpha)[f(\zeta) - f_\varepsilon(\zeta)]d\zeta \leq \mu(z,\alpha)\varepsilon, \right|$$

we have inequality. That is why,

$$|f(z) - f_{\varepsilon\alpha}(z)| \leq \frac{1}{2\pi}[C\alpha + \mu(z,\alpha)\varepsilon] \qquad (2.3)$$

is formed.

$\mu(z,\alpha) \to \infty$, if $\alpha \to 0$,, otherwise the problem is a classical correct problem.

If the Carlemann function is given, then $\mu(z,\alpha)$ is also given, and if the value of a is determined from (2.3), this parameter is optimal.

Adabiyotlar ro'yxati

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