



**МИНИСТЕРСТВО ВЫСШЕГО И СРЕДНЕГО СПЕЦИАЛЬНОГО
ОБРАЗОВАНИЯ РЕСПУБЛИКИ УЗБЕКИСТАН**

**ТАШКЕНТСКИЙ ГОСУДАРСТВЕННЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ ИМЕНИ
НСЛАМА КАРИМОВА**

БЕЛОРУССКИЙ НАЦИОНАЛЬНЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

**БЕЛОРУССКО-УЗБЕКСКИЙ СОВМЕСТНЫЙ МЕЖОТРАСЛЕВОЙ
ИНСТИТУТ ПРИКЛАДНЫХ ТЕХНИЧЕСКИХ КВАЛИФИКАЦИЙ В
ГОРОДЕ ТАШКЕНТ**

**НАУЧНО-ИССЛЕДОВАТЕЛЬСКИЙ ИНСТИТУТ ФИЗИКИ
ПОЛУПРОВОДНИКОВ И МИКРОЭЛЕКТРОНИКИ ПРИ НАЦИОНАЛЬНОМ
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GREENS FUNCTION FOR CLASS $A(z)$ -ANALYTIC FUNCTIONS

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Let $A(z)$ be an antianalytic function, i. e. $\frac{\partial A}{\partial z} = 0$ in the domain $D \subset \mathbb{C}$; moreover, let $|A(z)| \leq C < 1$ for all $z \in D$. The function $f(z)$ is said to be $A(z)$ -analytic in the domain D if for any $z \in D$, the following equality holds:

$$\frac{\partial f}{\partial \bar{z}} = A(z) \frac{\partial f}{\partial z} \quad (1)$$

We denote by $O_A(D)$ the class of all $A(z)$ -analytic functions defined in the domain D .

According to, the function

$$\psi(z; a) = z - a + \overline{\int_{\gamma(a; z)} A(\bar{\tau}) d\tau}$$

is an $A(z)$ -analytic functions.

The following set is an open subset of D :

$$L(a; r) = \left\{ | \psi(z; a) | = \left| z - a + \overline{\int_{\gamma(a; z)} A(\bar{\tau}) d\tau} \right| < r \right\}.$$

For sufficiently small $r > 0$, this set compactly lies in D (we denote this fact by $L(a; r) \subset\subset D$) and contains the point a . This set $L(a; r)$ is called the $A(z)$ -lemniscate centered at the point a . The lemniscate $L(a; r)$ is a simply - connected set (see [1]).

Let $f = u + iv$.

Definition 1 [4]. A double differentiable function $u \in C^2(D), u : D \rightarrow \mathbb{R}$ is called $A(z)$ -harmonic in the domain of D , if it satisfies the differential equation in D :

$$\left. -2\bar{A} \frac{\partial u}{\partial \bar{z}} \right) = 0. \quad (2)$$

The class of $A(z)$ -harmonic functions in the domain of D is denoted as $h_A(D)$. Thus, the real part and hence the imaginary part, of the $A(z)$ -harmonic function in the domain of D .

For $A(z)$ -harmonic functions, the following Dirichlet problem is naturally considered:

Dirichlet problem [4]. A bounded domain of $E \subset D$ is given and a continuous function of $u(\zeta)$ is the boundary of ∂E . It is required to find $A(z)$ -harmonic in the domain of E , continuous on the closure of \bar{E} , the function of $u(z) \in h_A(E) \cap C(\bar{E})$: $u(\zeta)|_{\partial E} = u(z)$.

Definition 2. The Green function of the Dirichlet problem for $A(z)$ -analytic functions in the domain of D , we will call $A(z)$ -analytic function of two complex variables $G(z, \zeta)$, which has the following properties:

1. $G(z, \zeta) = \frac{1}{2\pi} \ln |\psi(z, \zeta)| + g(z, \zeta)$, where the function $g(z, \zeta)$ is continuous over a set of variables at $z, \zeta \in D$, $A(z)$ -harmonic over z in D at any $z \in D$: $G(z, \zeta) \in h_A(D)$.

2. $A(z)$ -analytic function $g(z, \zeta) \in C(\bar{D}_\zeta)$ is continuous in $\zeta \in \bar{D}$ for any $z \in D$. Thus, the $G(z, \zeta) = 0$ for any z lying on the border ∂D :

$$\lim_{z \rightarrow \zeta} G(z, \zeta) = 0.$$

With the help of the Green function class $A(z)$ -analytic functions, you can write a solution to the Dirichlet problem. First, we will show one result in this direction, which has an auxiliary value. Let be a measurable set $M \subset \partial D$ of positive Lebesgue measure.

Theorem. Let the $A(z)$ -Green's function of the Dirichlet problem for class $A(z)$ -analytic functions in the domain of D be continuous up to the boundary of D with its first order partial derivatives in $\operatorname{Re} \zeta = \xi$ and $\operatorname{Im} \zeta = \eta$ (with the exception of the point $z \in D$). Then any $u(z)$ function, $A(z)$ -harmonic in the D domain and is continuously differentiable up to its values on the ∂D boundary curve by the formula

$$u(z) = \int_{\partial D} u(\zeta) \frac{\partial}{\partial n} G(z; \zeta) |d\zeta + A(\zeta) d\bar{\zeta}|, \quad (3)$$

$$\text{where } u(\zeta) = \begin{cases} 1, & \text{in } M, \\ 0, & \text{in } \partial D \setminus M. \end{cases}$$

If the $E \subset D$ domain is a lemniscate of $E = L(a; r)$ then

$$\omega_\zeta(z) = \frac{r(\psi(z; a) - \psi(\zeta; a))}{r^2 - \psi(z; a)\overline{\psi(\zeta; a)}}, \quad G(z; \zeta) = \frac{1}{2\pi i} \ln |\omega_\zeta(z)|.$$

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