

REMARKS ON THE METRIC INDUCED BY THE ROBIN FUNCTION

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ABSTRACT. Let D be a smoothly bounded pseudoconvex domain in \mathbb{C}^n , $n \geq 1$. Using $G(z, p)$, the Green function for D with pole at $p \in D$ associated with the standard sum-of-squares Laplacian, N. Levenberg and H. Yamaguchi had constructed a Kähler metric (the so-called A -metric) using the Robin function $A(p)$ arising from $G(z, p)$. The purpose of this article is to study this metric by deriving its boundary asymptotics and using them to calculate the holomorphic sectional curvature along normal directions. It is also shown that the A -metric is comparable to the Kobayashi (and hence to the Bergman and Carathéodory metrics) when D is strongly pseudoconvex. The unit ball in \mathbb{C}^n is also characterized among all smoothly bounded strongly convex domains on which the A -metric has constant negative holomorphic sectional curvature. This may be regarded as a version of Lu-Qi Keng's theorem for the Bergman metric.

1. INTRODUCTION

Let D be a smoothly bounded domain in \mathbb{C}^n , $n \geq 1$ with smooth defining function $\psi(z)$ so that $D = \{\psi < 0\}$. For $p \in D$, let $G(z, p)$ be the Green function for D with pole at p associated to the standard Laplacian

$$\Delta = 4 \sum_{j=1}^n \frac{\partial^2}{\partial z_j \partial \bar{z}_j}$$

on $\mathbb{C}^n \approx \mathbb{R}^{2n}$. The notation for the Green function will be enhanced to $G_D(z, p)$ if the need to emphasize its dependence on D arises. Then $G(z, p)$ is the unique function satisfying $\Delta G(z, p) = 0$ on $D \setminus \{p\}$, $G(z, p) \rightarrow 0$ as $z \rightarrow \partial D$ and $G(z, p) - |z - p|^{-2n+2}$ is harmonic near p . Let $H_p(z)$ be harmonic on D , continuous on \bar{D} and such that $H_p(z) = -|z - p|^{-2n+2}$ for $z \in \partial D$. The existence of such a function is guaranteed by the solution to the Dirichlet problem and

$$G(z, p) = |z - p|^{-2n+2} + H_p(z)$$

is then the Green function for D with pole at p . Therefore

$$A(p) := \lim_{z \rightarrow p} \left(G(z, p) - |z - p|^{-2n+2} \right)$$

exists for each $p \in D$ and is called the Robin constant at p and the map $p \mapsto A(p)$ is the Robin function for D . Said differently $A(p) = H_p(0)$. Hence it is possible to rewrite the expression for $G(z, p)$ as

$$(1.1) \quad G(z, p) = |z - p|^{-2n+2} + A(p) + h_p(z)$$

where $h_p(z) = H_p(z) - H_p(0)$ is harmonic on D and satisfies $h_p(p) = 0$ for all $p \in D$. The maximum principle implies that $A(p) < 0$ for all $p \in D$ and it was shown by Yamaguchi in [13] that $p \mapsto -A(p)$ is a real analytic exhaustion function for D . The assertion that $A(p)$ is real analytic is entirely local and as such does not require any smoothness hypothesis on ∂D while the latter statement that $-A(p)$ is an exhaustion only needs the domain to be one where the Dirichlet problem can be solved. These claims are therefore valid on a much larger class of bounded domains than the smoothly bounded ones, the point here of course being that the smoothness assumption on ∂D does not play any vital role so far. Further understanding of the Robin function came through the work of Levenberg-Yamaguchi ([10]) where they derived explicit expressions for the complex Hessians of $-A$ and $\log(-A)$ on smoothly bounded domains using the technique of variation of domains. To describe this briefly, fix $p_0 \in D$ and $a \in \mathbb{C}^n$ a non-zero

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The Metric Induced By The Robin Function

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The Metric Induced By The Robin Function:

The Metric Induced by the Robin Function Norman Levenberg, Hiroshi Yamaguchi, 1991 This paper continues Yamaguchi's earlier work on the Robin function for bounded domains in \mathbb{C}^n . Yamaguchi showed that if the domain D is smoothly bounded and pseudoconvex then the Robin function and its logarithm are both real analytic strongly pseudoconvex exhaustions of the domain. It follows that they may be used as potentials to define Kähler metrics on the domain. In this paper the authors study the properties of these Kähler metrics concentrating on the question of completeness. By using an affine scaling technique to blow up the domain at points near the boundary the scaling constant grows roughly as the inverse of the distance to the boundary. The authors study in some detail the behaviour of the Robin function and the induced metric near the boundary of the domain. They show that if the domain is either strongly pseudoconvex or geometrically convex then the metric associated to the logarithm of the Robin function is complete. They also conjecture that this is true in general for any smoothly bounded pseudoconvex domain.

Theory and Applications of Holomorphic Functions on Algebraic Varieties over Arbitrary Ground Fields Oscar Zariski, 1951

Kernel Functions, Analytic Torsion, and Moduli Spaces John David Fay, 1992 This memoir is a study of Ray-Singer analytic torsion for hermitian vector bundles on a compact Riemann surface C . The torsion is expressed through the trace of a modified resolvent. Thus one can develop perturbation curvature formulae for the Green-Szegő kernel and also for the torsion in terms of the Ahlfors-Bers complex structure of the Teichmüller space and Mumford complex structure of the moduli space of stable bundles of degree zero on C .

Coarse Cohomology and Index Theory on Complete Riemannian Manifolds John Roe, 1993 July 1993 volume 104 number 497 fourth of 6 numbers

Essays on Geometry A. Muhammed Uludağ, Ayberk Zeytin, 2025-01-27 The book is a comprehensive compilation of diverse articles delving into various intriguing topics within the realm of geometry. Each article is refereed by prominent researchers in the field. The book contains research articles offering valuable insights and original results making it a valuable resource for researchers in the field as well as survey articles that review current developments and list open problems.

L2 Approaches in Several Complex Variables Takeo Ohsawa, 2018-11-28 This monograph presents the current status of a rapidly developing part of several complex variables motivated by the applicability of effective results to algebraic geometry and differential geometry. Special emphasis is put on the new precise results on the L^2 extension of holomorphic functions in the past 5 years. In Chapter 1 the classical questions of several complex variables motivating the development of this field are reviewed after necessary preparations from the basic notions of those variables and of complex manifolds such as holomorphic functions, pseudoconvexity, differential forms and cohomology. In Chapter 2 the L^2 method of solving the $\bar{\partial}$ equation is presented emphasizing its differential geometric aspect. In Chapter 3 a refinement of the Oka-Cartan theory is given by this method. The L^2 extension theorem with an optimal constant is included, obtained recently by Z. Błocki and separately by Q. A. Guan and X. Y. Zhou. In Chapter 4 various results on

the Bergman kernel are presented including recent works of Maitani Yamaguchi Berndtsson Guan Zhou and Berndtsson Lempert Most of these results are obtained by the L2 method In the last chapter rather specific results are discussed on the existence and classification of certain holomorphic foliations and Levi flat hypersurfaces as their stable sets These are also applications of the L2 method obtained during the past 15 years Imbeddings of Three-Manifold Groups Francisco González-Acuña, Wilbur Carrington Whitten, 1992 This paper deals with the two broad questions of how 3 manifold groups imbed in one another and how such imbeddings relate to any corresponding lowercase Greek Π_1 injective maps In particular we are interested in 1 determining which 3 manifold groups are not cohopfian that is which 3 manifold groups imbed properly in themselves 2 determining the knot subgroups of a knot group and 3 determining when surgery on a knot K yields a lens or lens like space and the relationship of such a surgery to the knot subgroup structure of lowercase Greek Π_1 S^3 K Our work requires the formulation of a deformation theorem for lowercase Greek Π_1 injective maps between certain kinds of Haken manifolds and the development of some algebraic tools **Deformation Quantization for Actions of**

\mathbb{R}^d Marc Aristide Rieffel, 1993 This work describes a general construction of a deformation quantization for any Poisson bracket on a manifold which comes from an action of \mathbb{R}^d on that manifold These deformation quantizations are strict in the sense that the deformed product of any two functions is again a function and that there are corresponding involutions and operator norms Many of the techniques involved are adapted from the theory of pseudo differential operators The construction is shown to have many favorable properties A number of specific examples are described ranging from basic ones such as quantum disks quantum tori and quantum spheres to aspects of quantum groups Geometric Complex Analysis Jisoo Byun, Hong Rae Cho, Sung Yeon Kim, Kang-Hyuk Lee, Jong-Do Park, 2018-09-08 The KSCV Symposium the Korean Conference on Several Complex Variables started in 1997 in an effort to promote the study of complex analysis and geometry Since then the conference met semi regularly for about 10 years and then settled on being held biannually The sixth and tenth conferences were held in 2002 and 2014 as satellite conferences to the Beijing International Congress of Mathematicians ICM and the Seoul ICM respectively The purpose of the KSCV Symposium is to organize the research talks of many leading scholars in the world to provide an opportunity for communication and to promote new researchers in this field **Brownian Motion on Nested Fractals** Tom Lindstrøm, 1990 Lindstrøm U of Oslo constructs Brownian motion on a reasonably general class of self similar fractals He deals with diffusions self similar fractals fractal Laplacians asymptotic distribution of eigenvalues nonstandard analysis Annotation copyright Book News Inc Portland Or

Complex Analysis and Digital Geometry Mikael Passare, 2009 Hokkaido Mathematical Journal, 1996 Mathematical Reviews, 1998

Notices of the American Mathematical Society American Mathematical Society, 1991 **Sūgaku Expositions**, 2000 *Annales Scientifiques de L'École Normale Supérieure*, 2008 **The Proceedings of the Fourth Conference on Hypercubes, Concurrent Computers, and Applications: Software, applications**, 1989 **American Book Publishing**

Record ,1992 The Cumulative Book Index ,1992 A world list of books in the English language Green's Functions,
Spectral Invariants, and a Positive Mass on Spheres Jean Steiner,2003

The Metric Induced By The Robin Function Book Review: Unveiling the Magic of Language

In a digital era where connections and knowledge reign supreme, the enchanting power of language has become much more apparent than ever. Its ability to stir emotions, provoke thought, and instigate transformation is really remarkable. This extraordinary book, aptly titled "**The Metric Induced By The Robin Function**," written by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we will delve into the book's central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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