



Steven George Krantz (1951 -) Celebrates his 70th Birthday

Arni S. R. Srinivasa Rao¹ · Siqi Fu² · Gregory Knese³ · Kaushal Verma⁴ · Brett Wick³

Received: 18 October 2023 / Accepted: 27 December 2023 / Published online: 8 February 2024
© The Author(s), under exclusive licence to Springer Nature Switzerland AG 2024

Professor Steven G. Krantz, a renowned complex and harmonic analyst, celebrated his 70th birthday in St. Louis, U.S.A. with his friends, collaborators, students, and family. On May 22 and 23, 2023 a conference in his honor entitled *PDE and Complex Analysis*¹ was held at Washington University in St. Louis, USA,² where Steven is currently a Professor of Mathematics

The celebrations actually began on May 21, when Chen Zhenhua, one of Steven's former graduate students, hosted a small gathering of former students and family at the Boat House in Forest Park, St. Louis. On May 22, a banquet in the Forest Park Golf Club House was hosted by the Mathematics Department. And, on May 23, Steven and his wife Randi³ hosted a wonderful reception.

All the authors of this guest editorial were on the conference program committee; they all contributed to the editing of this special issue in the journal *Complex Analysis and Operator Theory* in honor of Professor Krantz.

The speakers at the conference were George E. Andrews, Fausto Di Biase, Harold Boas, Gordon Chen, Liwei Chen, Charlie Fefferman, Robert Greene, Christer Kiselman, Dima Khavinson, Greg Lawler, Songying Li, Bingyuan Liu, Erik Low, Henri

¹ The two-day event was sponsored by the Department of Mathematics, Washington University in St. Louis, U.S.A.; Medical College of Georgia, Augusta University, U.S.A.; Springer, Elsevier, CRC Press, and Barry Segal (of Barry Segal Holdings), U.S.A.

² See the conference page (<https://www.math.wustl.edu/~arao/sgk70/index.htm>) for all the invited speakers and the program.

³ We thank Mrs. Randi Ruden Krantz for her support, for sharing photos, and for her edits on the draft of the guest editorial.

Communicated by Daniel Alpay.

This article is part of Topical Collection in honour of the 70th Birthday of Professor S.G. Krantz.

✉ Arni S. R. Srinivasa Rao
arrao@augusta.edu

¹ Augusta University, Augusta, USA

² Rutgers University, New Brunswick, USA

³ Washington University in St. Louis, St. Louis, USA

⁴ Indian Institute of Science, Bengaluru, India

Martikainen, Gerald (Jerry) McNerney, Harold Parks, William Paulsen, Richard Rochberg, John Ryan, Rodolfo Torres, C. Eugene Wayne, Pavel M. Wojcicki, Hung-Hsi Wu, and, Ming Xiao.

1 Brief Bio

Steven G. Krantz was born in San Francisco, California on February 3, 1951. He received a B.A. degree from the University of California at Santa Cruz in 1971 and a Ph.D. from Princeton University in 1974. His thesis advisor was Elias M. Stein. Other profound influences on Steven's mathematical development were Joseph J. Kohn, Edward Nelson, and Frederick J. Almgren.

Prior to joining Washington University in St. Louis, Steven Krantz taught at UCLA, Princeton University, and the Pennsylvania State University. He was Chairman of the Washington University Mathematics Department for five years. Krantz has had 9 Masters students and 20 Ph.D. students. He has written more than 160 books and more than 350 scholarly papers. In addition, he is a former Editor-in-Chief of *The Notices of the AMS* and a former editorial board member of *Memoirs of the AMS*. He currently edits journals, namely, *The Journal of Mathematical Analysis and Applications*, *Complex Variables and Elliptic Equations*, *the American Mathematical Monthly*, etc. Most impressive, he is the founding editor and current Editor-in-Chief of the *Journal of Geometric Analysis* which he continues to edit. He is the creator, founder, and edi-

Fig. 1 Steven G. Krantz





Fig. 2 Krantz 70th Birthday conference in St. Louis, held during May 22–23, 2023. Front row from right: Mrs Randi Ruden Krantz and Steven G. Krantz. Photo courtesy: Mary Ann Stenner

tor of the new journal *Complex Analysis and its Synergies*. Apart from his research monographs and well-known textbooks, Krantz has written several books of broader interest in the mathematics community such as *A Mathematician Comes of Age* by the Mathematical Association of America (2012).

Krantz has written more than 160 books. These include popular books in mathematics, and monographs. He has also edited several books. It would be beyond the scope of this guest editorial to provide details of all of all these books and we will focus briefly on the most influential ones. His book titled *Function Theory of Several Complex Variables*, a reprint of the 1992 edition, AMS Chelsea Publishing, Providence, RI, 2001 is one of the frequently used graduate-level resources on several complex variables. The first edition of this book was published by Wiley-Interscience in 1982. The reviewer of the first edition in the MR database writes, “The author has written what is sure to become one of the standard graduate textbooks on several complex variables. His conversational style of writing makes this book a pleasure to read..... His book will be valuable to graduate students seeking to learn the rudiments of the $\bar{\partial}$ -approach to complex analysis.” Krantz’s book, co-authored with Harold R. Parks, titled *A Primer of Real Analytic Functions* was first published in 1992. The MR review of this edition notes that “This well-organized and clearly written advanced textbook introduces students to analytic functions of one or more real variables.....Many historical remarks, examples and references to the literature encourage the beginner to study further this ample, valuable and exciting theory.” A second edition was printed by Birkhauser in

2002. His other book with Harold R. Parks titled *The implicit function theorem: History, theory, and applications*, Birkhäuser Boston, Inc., Boston, MA, 2002. The review on this book in MR database writes “This is an excellent book devoted to the implicit function theorem and related results (like the inverse function theorem) that play one of the most important roles in modern mathematics.The book is mainly self-contained and undoubtedly will serve as a useful resource for advanced undergraduates, graduate students, professional mathematicians, and scientists of other types.”

Professor Krantz has supervised 20 Ph.D. students, 9 Masters students, and several postdoctoral fellows.

Krantz’s major awards and recognitions include the Chauvenet Prize, the Beckenbach Book Award, the Kemper Prize, and several JMM invitations as the AMS Special Session invited speaker. He was recently named to the Sequoia High School Hall of Fame. Krantz was one of the inaugural AMS Fellows in 2012.

Krantz continues to inspire through his research in harmonic analysis, several complex variables, and PDEs, and very recently he started collaborating with Arni S. R. Srinivasa Rao on problems arising in the epidemiology of COVID-19 models, artificial intelligence, and other applications in the real world (Figs. 1 and 2).

2 Brief Overview of Research

In this section, we give some highlights of Krantz’s research.

- (1) Krantz’s work with Robert E. Greene on the asymptotic expansion of Bergman kernel function of a strictly pseudoconvex domain with smooth boundary by Charles Fefferman (1974) to understand stability under perturbation of the boundary of D , where D is a \mathbb{C}^∞ strongly pseudoconvex domain in \mathbb{C}^n . This work established major recognition for Steven.
- (2) Krantz, in a series of collaborative articles with Robert E. Greene, showed how their investigations help visualizing the geometry of strongly pseudoconvex domains. These investigations and the fundamental ideas that shaped stability results on the perturbed boundary of D by Krantz were nicely summarized in an invited talk by Robert Greene at the conference
- (3) Krantz and Greene especially studied Fefferman’s asymptotic expansion and established stability at the boundary by first establishing stability of the Kohn solution of the $\bar{\partial}$ problem. The Bergman kernel and geometric properties of the Bergman metric continue to inspire Krantz’s recent research to date.
- (4) A summary of their research and others’ research in holomorphic geometry of domains in complex manifolds was nicely summarized in a textbook form and published in 2011. See Greene, Kim, and Krantz (2011) *The Geometry of Complex Domains*. Krantz’s collaborative work with Robert Greene and Alexander Isaev explores the interplay between a bounded domain and its automorphism group. The overarching theme is to understand the extent to which the automorphism group determines the biholomorphism type of the domain. The Greene-Krantz conjecture, which is still open in its full generality, has served as the main motivating question for several results in this area.

- (5) In a series of papers with Song-Ying Li, Krantz laid the foundations for harmonic analysis in several complex variables. These papers contain a number of fundamental results, including the duality of BMO and H^1 .
- (6) In a series of papers with Marco M. Peloso, Krantz has studied the Bergman kernel and related geometry on the worm domain of Diederich and Fornæss.
- (7) Another noteworthy result by Krantz was on the Schwarz lemma and about the rigidity of holomorphic self-maps of the unit ball in \mathbb{C}^n . Krantz (with Dan Burns in 1994) has extended the proof of the Schwarz lemma to smoothly bounded strongly pseudoconvex domains. This result is generally referred to as a *boundary Schwarz lemma*.
- (8) Krantz has in recent years applied mathematical models and methods to understand epidemic spread. For example, Krantz and Rao studied under-reporting in COVID-19 cases during March 2020 which was the first such estimate for several countries in the world. This work gathered worldwide science and health media attention and assisted in COVID-19 pandemic planning.

3 Final Remarks

Krantz's honesty in his approach to general life and his approach to handling collaborations, his vast knowledge of mathematics and sharing insights with junior collaborators, and his willingness to help others made us excited to celebrate his life achievements through his 70th birthday conference and these proceedings. We wish Krantz's continued success in research and leadership in the subject area in the years to come.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.