

Best Approximation in the Mean by Analytic and Harmonic Functions

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Abstract: We consider the problem of finding the best harmonic or analytic approximant to a given function. We discuss when the best approximant is unique, and what regularity properties the best approximant inherits from the original function. All our approximations are done in the mean with respect to Lebesgue measure in the plane or higher dimensions.

1. Introduction.

For $n \geq 2$, let \mathbf{B}_n denote the unit ball in \mathbf{R}^n , and for $p \geq 1$ let L^p denote the Banach space of p -summable functions on \mathbf{B}_n . Let $L^p_\lambda(\mathbf{B}_n)$ denote the subspace of harmonic functions on \mathbf{B}_n that are p -summable. When $n = 2$, we often write \mathbf{D} instead of \mathbf{B}_2 , and we let A^p denote the Bergman space of analytic functions in L^p .

Let ω be a function in L^p . We are interested in finding the best approximation to ω in A^p and $L^p_\lambda(\mathbf{B}_n)$. Existence of a best approximant is straightforward; this paper considers the following two qualitative properties:

- (i) Uniqueness of best approximants, when $p = 1$.
- (ii) Hereditary regularity of the best approximant f^* inherited from that of ω , e.g., whether continuity, Hölder continuity, real-analyticity of ω in the closed unit disk enforce those properties in ω 's best approximant.

These and many other similar questions have been well-studied for the case when the normalized area measure $dA := \frac{1}{\pi} dx dy$ is replaced by $d\sigma = \frac{d\theta}{2\pi}$ on the unit circle \mathbf{T} and the spaces A^p are replaced, accordingly, by the familiar Hardy spaces H^p (cf., e.g., [Ak], [D], [Ka], [Kh2–6], [RS], [W], and references cited therein). In that situation, the approach based on Hahn–Banach duality and the F. and M. Riesz theorem identifying the

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Approximation Of Functions In The Mean

J. Nowinski



Approximation Of Functions In The Mean:

Approximation of Functions in the Mean Academ Steklov Institute Of Math,1970-03 Approximation of Functions in the Mean S. B. Stečkin,1969 The Theory of Approximation Dunham Jackson,1930 *Encyclopaedia of Mathematics* Michiel Hazewinkel,2013-12-20 *Elementary Linear Algebra* Howard Anton,Chris Rorres,2010-04-12 *Elementary Linear Algebra* 10th edition gives an elementary treatment of linear algebra that is suitable for a first course for undergraduate students The aim is to present the fundamentals of linear algebra in the clearest possible way pedagogy is the main consideration Calculus is not a prerequisite but there are clearly labeled exercises and examples which can be omitted without loss of continuity for students who have studied calculus Technology also is not required but for those who would like to use MATLAB Maple or Mathematica or calculators with linear algebra capabilities exercises are included at the ends of chapters that allow for further exploration using those tools

Machines, Computations, and Universality Jérôme Durand-Lose,2007-08-23 This book constitutes the refereed proceedings of the 5th International Conference on Machines Computations and Universality MCU 2007 held in Orleans France September 2007 The 18 revised full papers presented together with nine invited papers cover Turing machines register machines word processing cellular automata tiling of the plane neural networks molecular computations BSS machines infinite cellular automata real machines and quantum computing

Methods of Numerical Approximation D. C. Handscomb,2014-05-16 *Methods of Numerical Approximation* is based on lectures delivered at the Summer School held in September 1965 at Oxford University The book deals with the approximation of functions with one or more variables through means of more elementary functions It explains systems to approximate functions such as trigonometric sums rational functions continued fractions and spline functions The book also discusses linear approximation including topics such as convergence of polynomial interpolation and the least squares approximation The text analyzes Bernstein polynomials Weierstrass theorem and Lagrangian interpolation The book also gives attention to the Chebyshev least squares approximation the Chebyshev series and the determination of Chebyshev series under general methods These general methods are useful when the student wants to investigate practical methods for finding forms of approximations under various situations One of the lectures concerns the general theory of linear approximation and the existence of a best approximation approach using different theorems The book also discusses the theory and calculation of the best rational approximations as well as the optimal approximation of linear functionals The text will prove helpful for students in advanced mathematics and calculus It can be appreciated by statisticians and those working with numbers theory

Applications of Functional Analysis in Engineering J. Nowinski,2013-03-09 Functional analysis owes its Origins to the discovery of certain striking analogies between apparently distinct disciplines of mathematics such as analysis algebra and geometry At the turn of the nineteenth century a number of observations made sporadically over the preceding years began to inspire systematic investigations into the common features of these three disciplines which have

developed rather independently of each other for so long It was found that many concepts of this triad analysis algebra geometry could be incorporated into a single but considerably more abstract new discipline which came to be called functional analysis In this way many aspects of analysis and algebra acquired unexpected and profound geometric meaning while geometric methods inspired new lines of approach in analysis and algebra A first significant step toward the unification and generalization of algebra analysis and geometry was taken by Hilbert in 1906 who studied the collection later called ℓ^2 composed of infinite sequences $x = (x_k)$ of numbers satisfying the condition that the sum $\sum_{k=1}^{\infty} x_k^2$ converges The collection ℓ^2 became a prototype of the class of collections known today as Hilbert spaces

Dictionary of Physics Palgrave Macmillan Ltd, 2016-04-30 The Dictionary of Physics is a major reference source in the vast and dynamic field of physics that caters for both the undergraduate and graduate student Spanning the space between the primary literature and educational texts it encompasses 16 000 entries and 1 8 million words in four volumes

On Approximation in the Mean by Analytic Functions V. G. Mazya, V. P. Khavin, JOHNS HOPKINS UNIV SILVER SPRING MD APPLIED PHYSICS LAB., 1969 Let E be an open set in the complex plane and let G be a domain containing E This paper is devoted to the investigation of conditions ensuring the possibility of the approximation in the L^p metric of functions analytic in E by functions analytic in G Author

Proceedings of the Ashkelon Workshop on Complex Function Theory (May 1996) Lawrence Allen Zalcman, 1997 This volume comprises the scientific proceedings of the Spring Workshop in Complex Function Theory held in Ashkelon Israel In content the papers represent a wide variety of interests within complex analysis ranging from approximation theory and the analytic theory of polynomials to quasiconformal mappings complex dynamics and spectral geometry

A Treatise on the Theory of Bessel Functions George Neville Watson, 1922 Bulletin (new Series) of the American Mathematical Society, 1894

Abstracts of Scientific and Technical Publications from the Massachusetts Institute of Technology, Including Abstracts of Doctors' Theses Massachusetts Institute of Technology, 1928 Including abstracts of doctors theses January 1 1927 Dec 31 1927

Colloquium Publications, 1930 Rendiconti Del Circolo Matematico Di Palermo Circolo matematico di Palermo, 1915 Transactions of the American Mathematical Society American Mathematical Society, 1921 Monthly journal devoted entirely to research in pure and applied mathematics and in general includes longer papers than those in the Proceedings of the American Mathematical Society

Abstracts of Scientific and Technical Publications from the Massachusetts Institute of Technology Massachusetts Institute of Technology, 1930 Probabilistic Structural Mechanics: Advances in Structural Reliability Methods Pol D. Spanos, Y.-T. Wu, 2013-03-13 This symposium is the seventh of a series of IUTAM sponsored symposia which focus on probabilistic methods in mechanics It is the sequel to the series of meetings in Coventry UK 1972 Southampton UK 1976 Frankfurt Oder Germany 1982 Stockholm Sweden 1984 Innsbruck Austria 1987 and Turin Italy 1991 The symposium focused on advances in the area of probabilistic mechanics with direct application to structural reliability issues The contributed papers

address collectively the four components of a structural reliability problem They are characterization of stochastic loads description of material properties in terms of fatigue and fracture response determination and quantitative assessment of the reliability of the structural system Four Keynote Lectures by V Bolotin Russia o Ditlevsen Denmark R Heller USA and F Ziegler Austria were delivered the remaining contributed papers were organized in ten technical sessions A reception was hosted by Dr Y Wu the first day of the symposium the second day of the symposium a banquet was hosted by Dr P Spanos with Dr N Abramson serving as the banquet speaker Closing remarks were provided by the IUTAM Secretary General Dr F Ziegler

Abstracts of Scientific and Technical Publications Massachusetts Institute of Technology, 1928

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Table of Contents Approximation Of Functions In The Mean

1. Understanding the eBook Approximation Of Functions In The Mean
 - The Rise of Digital Reading Approximation Of Functions In The Mean
 - Advantages of eBooks Over Traditional Books
2. Identifying Approximation Of Functions In The Mean
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Approximation Of Functions In The Mean
 - User-Friendly Interface
4. Exploring eBook Recommendations from Approximation Of Functions In The Mean
 - Personalized Recommendations
 - Approximation Of Functions In The Mean User Reviews and Ratings
 - Approximation Of Functions In The Mean and Bestseller Lists
5. Accessing Approximation Of Functions In The Mean Free and Paid eBooks
 - Approximation Of Functions In The Mean Public Domain eBooks
 - Approximation Of Functions In The Mean eBook Subscription Services
 - Approximation Of Functions In The Mean Budget-Friendly Options
6. Navigating Approximation Of Functions In The Mean eBook Formats
 - ePub, PDF, MOBI, and More
 - Approximation Of Functions In The Mean Compatibility with Devices
 - Approximation Of Functions In The Mean Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Approximation Of Functions In The Mean
 - Highlighting and Note-Taking Approximation Of Functions In The Mean
 - Interactive Elements Approximation Of Functions In The Mean
8. Staying Engaged with Approximation Of Functions In The Mean

- Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers
9. Balancing eBooks and Physical Books
- Benefits of a Digital Library
 - Creating a Diverse Reading Collection
10. Overcoming Reading Challenges
- Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine
- Setting Reading Goals
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information
- Fact-Checking eBook Content
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
- Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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