



Singular Integral Operators Supported in Higher Dimensional Surfaces

Ahmad Al-Salman

Abstract. Motivated by the composition of singular integral operators, we introduce a class of singular integral operators in the Euclidean space $\mathbb{R}^n$ with kernels supported in surfaces in $\mathbb{R}^n \times \mathbb{R}^n$. The surfaces are allowed to be very flat at the origin in $\mathbb{R}^n \times \mathbb{R}^n$. The boundedness of the operators on L^p is proved under the assumption that the kernels are rough in $L(\log L)^2(\mathbb{S}^{n-1} \times \mathbb{S}^{n-1})$.

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1. Introduction and Statement of Results

Singular integral operators are central part in harmonic analysis. Since the publication of the fundamental papers of Calderón and Zygmund [9, 10], the theory of singular integral operators has received a considerable amount of attention. For the theory of the classical singular integral operators on the n -dimensional Euclidean space $\mathbb{R}^n$ ($n \geq 2$), one can consult [7, 9–12, 15], among others. For the theory in the product domains settings, we refer readers to [1, 6, 8, 13], and references therein. In this paper, we are interested in investigating the L^p boundedness of a class of singular integral operators in $\mathbb{R}^n$ with kernels supported in the product domain $\mathbb{R}^n \times \mathbb{R}^n$ which arises naturally when considering composition of singular integral operators in $\mathbb{R}^n$.

For $n \geq 2$, let $\mathbb{S}^{n-1}$ be the unit sphere in $\mathbb{R}^n$ equipped with the normalized Lebesgue measure $d\sigma$. For nonzero $y \in \mathbb{R}^n$, we set $y' = |y|^{-1}y$. In [10], Calderón and Zygmund introduced the method of rotations and proved that the singular integral operator

$$S_{\Omega}f(x) = \text{p.v.} \int_{\mathbb{R}^n} f(x-y) |y|^{-n} \Omega(y') dy, \quad (1.1)$$

Smooth Molecular Decompositions Of Functions And Singular Integral Operators

Jeffrey A. Hogan



Smooth Molecular Decompositions Of Functions And Singular Integral Operators:

Smooth Molecular Decompositions of Functions and Singular Integral Operators John E. Gilbert, 2002 Under minimal assumptions on a function ψ the authors obtain wavelet type frames of the form $\psi_{j,k,r}$ $1 \leq j \leq n$ $\psi_{j,k,r}$ in integer k in integer $0 \leq r \leq s$ This collection is shown to be a frame for a scale of Triebel Lizorkin spaces which includes Lebesgue Sobolev and Hardy spaces and the reproducing formula converges in norm as well as pointwise a.e. The construction follows from a characterization of those operators which are bounded on a space of smooth molecules This characterization also allows us to decompose a broad range of singular integral operators in terms of

Pointwise Variable Anisotropic Function Spaces on $\mathbb{R}^n$ Shai Dekel, 2022-04-04 Spaces of homogeneous type were introduced as a generalization to the Euclidean space and serve as a sufficient setting in which one can generalize the classical isotropic Harmonic analysis and function space theory This setting is sometimes too general and the theory is limited Here we present a set of flexible ellipsoid covers of $\mathbb{R}^n$ that replace the Euclidean balls and support a generalization of the theory with fewer limitations

Time-Frequency and Time-Scale Methods Jeffrey A. Hogan, 2007-12-21 Developed in this book are several deep connections between time frequency Fourier Gabor analysis and time scale wavelet analysis emphasizing the powerful adaptive methods that emerge when separate techniques from each area are properly assembled in a larger context While researchers at the forefront of developments in time frequency and time scale analysis are well aware of the benefits of such a unified approach there remains a knowledge gap in the larger community of practitioners about the precise strengths and limitations of Fourier Gabor analysis versus wavelets This book fills that gap by presenting the interface of time frequency and time scale methods as a rich area of work

The Mathematical Heritage of Guido Weiss Eugenio Hernández, Marco Maria Peloso, Fulvio Ricci, Fernando Soria, Anita Tabacco, 2025-01-31 This work is a tribute to the life and work of Guido Weiss a mathematician whose profound contributions shaped the field of harmonic analysis over a span of more than six decades His groundbreaking research from pioneering real and complex analysis to his later work on wavelets continues to influence generations of scholars More than just a researcher Guido was a mentor collaborator and friend to many creating a global community of mathematicians His charisma and generosity fostered lasting professional and personal connections across continents touching lives far beyond academia This volume features contributions of collaborators students and colleagues of Guido who had a particularly intense relationship with him From a heartfelt remembrance of Guido Weiss to advanced discussions on spectral synthesis and wavelet theory this collection contains a diverse landscape of mathematical results Readers will delve into topics such as the compactness of bilinear commutators the intricacies of analytic families in extrapolation theory and the intersections of time frequency analysis with modern learning techniques With contributions to Hardy spaces Haar multipliers and crystalline measures this book serves both as a tribute to past achievements and a beacon for future exploration

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Twentieth Century Harmonic Analysis J.S. Byrnes, 2001-09-30 Almost a century ago harmonic analysis entered a still continuing Golden Age with the emergence of many great masters throughout Europe. They created a wealth of profound analytic methods to be successfully exploited and further developed by succeeding generations. This flourishing of harmonic analysis is today as lively as ever as the papers presented here demonstrate. In addition to its own ongoing internal development and its basic role in other areas of mathematics, physics and chemistry, financial analysis, medicine and biological signal processing, harmonic analysis has made fundamental contributions to essentially all twentieth century technology based human endeavours including telephone, radio, television, radar, sonar, satellite communications, medical imaging, the Internet and multimedia. This ubiquitous nature of the subject is amply illustrated. The book not only promotes the infusion of new mathematical tools into applied harmonic analysis but also to fuel the development of applied mathematics by providing opportunities for young engineers, mathematicians and other scientists to learn more about problem areas in today's technology that might benefit from new mathematical insights.

The Rational Function Analogue of a Question of Schur and Exceptionality of Permutation Representations Robert M. Guralnick, Peter Müller, Jan Saxl, 2003 Investigates the analogous question for rational functions. This book describes the Galois theoretic translation based on Chebotarev's density theorem leads to a certain property of permutation groups called exceptionality.

Approximation and Entropy Numbers of Volterra Operators with Application to Brownian Motion Mikhail Anatol'evich Lifshits, Werner Linde, 2002 This text considers a specific Volterra integral operator and investigates its degree of compactness in terms of properties of certain kernel functions. In particular, under certain optimal integrability conditions, the entropy numbers $e_n(T_\rho)$ satisfy $\| \cdot \|_{c_1(\rho)}$.

Elliptic Partial Differential Operators and Symplectic Algebra William Norrie Everitt, L. Markus (Lawrence), 2003 This investigation introduces a new description and classification for the set of all self adjoint operators not just those defined by differential boundary conditions which are generated by a linear elliptic partial differential expression $A \mathbf{x} \in D \sum_{j=0}^m a_j \mathbf{x}^{(j)} \in \text{DEGREES } s$ for all $\mathbf{x} \in \Omega$ in a region Ω with compact closure $\overline{\Omega}$ and C^∞ smooth boundary $\partial\Omega$ in Euclidean space E^n . The order $2m \geq 2$ and the spatial dimension

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