Groupoid Metrization Theory With Applications To Analysis On Quasi Metric Spaces And Functional Analysis Applied And Numerical Harmonic Analysis

Recent Advances in Harmonic Analysis and Applications features selected contributions from the AMS conference which took place at Georgia Southern University, Statesboro in 2011 in honor of Professor Konstantin Oskolkov's 65th birthday. The contributions are based on two special sessions, namely "Harmonic Analysis and Applications" and "Sparse Data Representations and Applications." Topics covered range from Banach space geometry to classical harmonic analysis and partial differential equations. Survey and expository articles by leading experts in their corresponding fields are included, and the volume also features selected high quality papers exploring new results and trends in Muckenhoupt-Sawyer theory, orthogonal polynomials, trigonometric series, approximation theory, Bellman functions and applications in differential equations. Graduate students and researchers in analysis will be particularly interested in the articles which emphasize remarkable connections between analysis and analytic number theory. The readers will learn about recent mathematical developments and directions for future work in the unexpected and surprising interaction between abstract problems in additive number theory and

experimentally discovered optical phenomena in physics. This book will be useful for number theorists, harmonic analysts, algorithmists in multi-dimensional signal processing and experts in physics and partial differential equations.

This book investigates the convergence and summability of both one-dimensional and multi-dimensional Fourier transforms, as well as the theory of Hardy spaces. To do so, it studies a general summability method known as theta-summation, which encompasses all the well-known summability methods, such as the Fejér, Riesz, Weierstrass, Abel, Picard, Bessel and Rogosinski summations. Following on the classic books by Bary (1964) and Zygmund (1968), this is the first book that considers strong summability introduced by current methodology. A further unique aspect is that the Lebesgue points are also studied in the theory of multi-dimensional summability. In addition to classical results, results from the past 20-30 years – normally only found in scattered research papers – are also gathered and discussed, offering readers a convenient "one-stop" source to support their work. As such, the book will be useful for researchers, graduate and postgraduate students alike.

This volume consists of contributions spanning a wide spectrum of harmonic analysis and its applications written by speakers at the February Fourier Talks from 2002 – 2013. Containing cutting-edge results by an impressive array of mathematicians, engineers and scientists in academia, industry and government, it will be an excellent reference for graduate students, researchers and professionals in pure and applied

mathematics, physics and engineering. Topics covered include: Special Topics in Harmonic Analysis Applications and Algorithms in the Physical Sciences Gabor Theory RADAR and Communications: Design, Theory, and Applications The February Fourier Talks are held annually at the Norbert Wiener Center for Harmonic Analysis and Applications. Located at the University of Maryland, College Park, the Norbert Wiener Center provides a state-of- the-art research venue for the broad emerging area of mathematical engineering.

This volume contains papers presented at the July, 1989 NATO Advanced Study Institute on Fourier Analysis and its Applications. The conference, held at the beautiful II Ciocco resort near Lucca, in the glorious Tuscany region of northern Italy, created a dynamic in teraction between world-renowned scientists working in the usually disparate communities of pure and applied Fourier analysts. The papers to be found herein include important new results in x-ray crystallography by Nobel Laureate Herbert Hauptman, the application of the new concept of bispectrum to system identification by renowned probabilist Athanasios Papoulis, fascinating appli cations of number theory in Fourier analysis by eminent electrical engineer Manfred R. Schroeder, and exciting concepts regarding polynomials with restricted coefficients by foremost mathematical problem solver Donald J. Newman. The remaining papers further illustrate the inherent power and beauty of classical Fourier analysis, whether the results presented were sought as an end in themselves, or whether these classical methods were employed as

a tool in illustrating and solving a particular applied problem. From antenna design to concert hall acoustics to image and speech processing to unimodular polynomi als, each conference participant benefited significantly from his or her exposure, in many cases for the first time, to those scientists on the other end of the spectrum from them selves. The purpose of this volume is to pass those benefits on to the reader. Das Ziel dieses Buches ist, die eigentlich elementargeometrischen Methoden der Differentialtopologie darzustellen. Es richtet sich an Studenten mit Grundkenntnissen in Analysis und allgemeiner Topologie. Wir beweisen Einbettungs-, Isotopie-und Transversalitätssätze und behandeln als wichtige Techniken den Satz von Sard, Partitionen der Eins, dynamische Systeme und (nach Serge Langs Vorbild) Sprays, die zusammenhängende Summe, Tubenumgebungen, Kra gen und das Zusammenkleben von berandeten Mannigfaltigkeiten längs des Randes. Wir haben, wie wohl heute jeder jüngere Topologe, aus Milnors Schriften [4, 5, 6J selbst viel gelernt, wovon sich mancherlei Spuren im Text finden, und auch Serge Langs vorzügliche Darstellung [3J haben wir gelegentlich benutzt - was ängstlich zu vermeiden einem Buch über Differentialtopologie ja auch nicht gut tun könnte. Die jedem Kapitel reichlich beigefügten Übungsaufgaben sind für einen Anfänger nicht immer leicht; im Text werden sie nicht be nutzt. Nicht behandelt sind in diesem Buch die Analysis auf Mannig faltigkeiten (Satz von Stokes), die Morse-Theorie, die algebraische Topologie der Mannigfaltigkeiten und die Bordismentheorie. Wir hoffen aber, daß sich unser Buch

als eine solide Grundlage für die nähere Bekanntschaft mit diesen weiterführenden Gebieten der Differentialtopologie erweisen wird. In diesem korrigierten Nachdruck sind zahlreiche kleine Versehen, die uns bekanntgeworden sind, berichtigt und einige Aufgaben hin zugekommen. Für Hinweise danken wir Kollegen und vielen interes sierten Lesern. Theodor Bröckt'r Regensburg, im August 1990 Klaus Jänich Inhaltsverzeichnis 1. Mannigfaltigkeiten und differenzierbare Strukturen. Ii 13 2. Der Tangentialraum ~ 3. Vektorraumbündel . 22 * 4. Lineare Algebra für Vektorraumbündel 34 ~ Lokale und tangentiale Eigenschaften. 45 5.

The 20th Century brought the rise of General Topology. It arose from the effort to establish a solid base for Analysis and it is intimately related to the success of set theory. Many Valued Topology and Its Applications seeks to extend the field by taking the monadic axioms of general topology seriously and continuing the theory of topological spaces as topological space objects within an almost completely ordered monad in a given base category C. The richness of this theory is shown by the fundamental fact that the category of topological space objects in a complete and cocomplete (epi, extremal mono)-category C is topological over C in the sense of J. Adamek, H. Herrlich, and G.E. Strecker. Moreover, a careful, categorical study of the most important topological notions and concepts is given - e.g., density, closedness of extremal subobjects, Hausdorff's separation axiom, regularity, and compactness. An interpretation of these structures, not only by the ordinary filter monad, but also by

many valued filter monads, underlines the richness of the explained theory and gives rise to new concrete concepts of topological spaces - so-called many valued topological spaces. Hence, many valued topological spaces play a significant role in various fields of mathematics - e.g., in the theory of locales, convergence spaces, stochastic processes, and smooth Borel probability measures. In its first part, the book develops the necessary categorical basis for general topology. In the second part, the previously given categorical concepts are applied to monadic settings determined by many valued filter monads. The third part comprises various applications of many valued topologies to probability theory and statistics as well as to non-classical model theory. These applications illustrate the significance of many valued topology for further research work in these important fields.

The aim of this book is to offer, in a concise, rigorous, and largely self-contained manner, a rapid introduction to the theory of distributions and its applications to partial differential equations and harmonic analysis. The book is written in a format suitable for a graduate course spanning either over one-semester, when the focus is primarily on the foundational aspects, or over a two-semester period that allows for the proper amount of time to cover all intended applications as well. It presents a balanced treatment of the topics involved, and contains a large number of exercises (upwards of two hundred, more than half of which are accompanied by solutions), which have been carefully chosen to amplify the effect, and substantiate the power and scope, of the theory of distributions. Graduate students, professional mathematicians, and scientifically trained people with a wide spectrum of mathematical

interests will find this book to be a useful resource and complete self-study guide. Throughout, a special effort has been made to develop the theory of distributions not as an abstract edifice but rather give the reader a chance to see the rationale behind various seemingly technical definitions, as well as the opportunity to apply the newly developed tools (in the natural build-up of the theory) to concrete problems in partial differential equations and harmonic analysis, at the earliest opportunity. The main additions to the current, second edition, pertain to fundamental solutions (through the inclusion of the Helmholtz operator, the perturbed Dirac operator, and their iterations) and the theory of Sobolev spaces (built systematically from the ground up, exploiting natural connections with the Fourier Analysis developed earlier in the monograph).

This monograph serves as a much-needed, self-contained reference on the topic of modulation spaces. By gathering together state-of-the-art developments and previously unexplored applications, readers will be motivated to make effective use of this topic in future research. Because modulation spaces have historically only received a cursory treatment, this book will fill a gap in time-frequency analysis literature, and offer readers a convenient and timely resource. Foundational concepts and definitions in functional, harmonic, and real analysis are reviewed in the first chapter, which is then followed by introducing modulation spaces. The focus then expands to the many valuable applications of modulation spaces, such as linear and multilinear pseudodifferential operators, and dispersive partial differential equations. Because it is almost entirely self-contained, these insights will be accessible to a wide audience of interested readers. Modulation Spaces will be an ideal reference for researchers in time-frequency analysis and nonlinear partial differential equations. It will also appeal to

graduate students and seasoned researchers who seek an introduction to the time-frequency analysis of nonlinear dispersive partial differential equations.

Functions of bounded variation represent an important class of functions. Studying their Fourier transforms is a valuable means of revealing their analytic properties. Moreover, it brings to light new interrelations between these functions and the real Hardy space and, correspondingly, between the Fourier transform and the Hilbert transform. This book is divided into two major parts, the first of which addresses several aspects of the behavior of the Fourier transform of a function of bounded variation in dimension one. In turn, the second part examines the Fourier transforms of multivariate functions with bounded Hardy variation. The results obtained are subsequently applicable to problems in approximation theory, summability of the Fourier series and integrability of trigonometric series.

Since publication of the initial papers in 2006, compressed sensing has captured the imagination of the international signal processing community, and the mathematical foundations are nowadays quite well understood. Parallel to the progress in mathematics, the potential applications of compressed sensing have been explored by many international groups of, in particular, engineers and applied mathematicians, achieving very promising advances in various areas such as communication theory, imaging sciences, optics, radar technology, sensor networks, or tomography. Since many applications have reached a mature state, the research center MATHEON in Berlin focusing on "Mathematics for Key Technologies", invited leading researchers on applications of compressed sensing from mathematics, computer science, and engineering to the "MATHEON Workshop 2013: Compressed Sensing and its Applications" in December 2013. It was the first workshop

specifically focusing on the applications of compressed sensing. This book features contributions by the plenary and invited speakers of this workshop. To make this book accessible for those unfamiliar with compressed sensing, the book will not only contain chapters on various applications of compressed sensing written by plenary and invited speakers, but will also provide a general introduction into compressed sensing. The book is aimed at both graduate students and researchers in the areas of applied mathematics, computer science, and engineering as well as other applied scientists interested in the potential and applications of the novel methodology of compressed sensing. For those readers who are not already familiar with compressed sensing, an introduction to the basics of this theory will be included.

The second of a two volume set on novel methods in harmonic analysis, this book draws on a number of original research and survey papers from well-known specialists detailing the latest innovations and recently discovered links between various fields. Along with many deep theoretical results, these volumes contain numerous applications to problems in signal processing, medical imaging, geodesy, statistics, and data science. The chapters within cover an impressive range of ideas from both traditional and modern harmonic analysis, such as: the Fourier transform, Shannon sampling, frames, wavelets, functions on Euclidean spaces, analysis on function spaces of Riemannian and sub-Riemannian manifolds, Fourier analysis on manifolds and Lie groups, analysis on combinatorial graphs, sheaves, co-sheaves, and persistent homologies on topological spaces. Volume II is organized around the theme of recent applications of harmonic analysis to function spaces, differential equations, and data science, covering topics such as: The classical Fourier transform, the non-linear Fourier

transform (FBI transform), cardinal sampling series and translation invariant linear systems. Recent results concerning harmonic analysis on non-Euclidean spaces such as graphs and partially ordered sets. Applications of harmonic analysis to data science and statistics Boundary-value problems for PDE's including the Runge–Walsh theorem for the oblique derivative problem of physical geodesy.

This landmark monograph presents the most recent mathematical developments in the analysis of ionospheric distortions of SAR images and offers innovative new strategies for their mitigation. As a prerequisite to addressing these topics, the book also discusses the radar ambiguity theory as it applies to synthetic aperture imaging and the propagation of radio waves through the ionospheric plasma, including the anisotropic and turbulent cases. In addition, it covers a host of related subjects, such as the mathematical modeling of extended radar targets (as opposed to point-wise targets) and the scattering of radio waves off those targets, as well as the theoretical analysis of the start-stop approximation, which is used routinely in SAR signal processing but often without proper justification. The mathematics in this volume is clean and rigorous – no assumptions are hidden or ambiguously stated. The resulting work is truly interdisciplinary, providing both a comprehensive and thorough exposition of the field, as well as an accurate account of a range of relevant physical processes and phenomena. The book is intended for applied mathematicians interested in the area of radar imaging or, more generally, remote sensing, as well as physicists and electrical/electronic engineers who develop/operate spaceborne SAR sensors and perform the data processing. The methods in the book are also useful for researchers and practitioners working on other types of imaging. Moreover, the book is accessible to graduate students in applied mathematics, physics, engineering, and related

disciplines. Praise for Transionospheric Synthetic Aperture Imaging: "I perceive that this text will mark a turning point in the field of synthetic aperture radar research and practice. I believe this text will instigate a new era of more rigorous image formation relieving the research, development and practitioner communities of inconsistent physical assumptions and numerical approaches." – Richard Albanese, Senior Scientist, Albanese Defense and Energy Development LLC

This book introduces computational proximity (CP) as an algorithmic approach to finding nonempty sets of points that are either close to each other or far apart. Typically in computational proximity, the book starts with some form of proximity space (topological space equipped with a proximity relation) that has an inherent geometry. In CP, two types of near sets are considered, namely, spatially near sets and descriptivelynear sets. It is shown that connectedness, boundedness, mesh nerves, convexity, shapes and shape theory are principal topics in the study of nearness and separation of physical aswell as abstract sets. CP has a hefty visual content. Applications of CP in computer vision, multimedia, brain activity, biology, social networks, and cosmology are included. The book has been derived from the lectures of the author in a graduate course on the topology of digital images taught over the past several years. Many of the students have provided important insights and valuable suggestions. The topics in this monograph introduce many forms of proximities with a computational flavour (especially, what has become known as the strong contact relation), many nuances of topological spaces, and point-free geometry.

The authors establish square function estimates for integral operators on uniformly rectifiable sets by proving a local theorem and applying it to show that such estimates are stable under

the so-called big pieces functor. More generally, they consider integral operators associated with Ahlfors-David regular sets of arbitrary codimension in ambient quasi-metric spaces. The local theorem is then used to establish an inductive scheme in which square function estimates on so-called big pieces of an Ahlfors-David regular set are proved to be sufficient for square function estimates to hold on the entire set. Extrapolation results for and Hardy space versions of these estimates are also established. Moreover, the authors prove square function estimates for integral operators associated with variable coefficient kernels, including the Schwartz kernels of pseudodifferential operators acting between vector bundles on subdomains with uniformly rectifiable boundaries on manifolds.

This textbook is an introduction to the theory and applications of finite tight frames, an area that has developed rapidly in the last decade. Stimulating much of this growth are the applications of finite frames to diverse fields such as signal processing, quantum information theory, multivariate orthogonal polynomials, and remote sensing. Featuring exercises and MATLAB examples in each chapter, the book is well suited as a textbook for a graduate course or seminar involving finite frames. The self-contained, user-friendly presentation also makes the work useful as a self-study resource or reference for graduate students, instructors, researchers, and practitioners in pure and applied mathematics, engineering, mathematical physics, and signal processing.

Groupoid Metrization TheoryWith Applications to Analysis on Quasi-Metric Spaces and Functional AnalysisSpringer Science & Business Media

The topics in this research monograph are at the interface of several areas of mathematics such as harmonic analysis, functional analysis, analysis on spaces of homogeneous type,

topology, and quasi-metric geometry. The presentation is self-contained with complete, detailed proofs, and a large number of examples and counterexamples are provided. Unique features of Metrization Theory for Groupoids: With Applications to Analysis on Quasi-Metric Spaces and Functional Analysis include: * treatment of metrization from a wide, interdisciplinary perspective, with accompanying applications ranging across diverse fields; * coverage of topics applicable to a variety of scientific areas within pure mathematics; * useful techniques and extensive reference material; * includes sharp results in the field of metrization. Professional mathematicians with a wide spectrum of mathematical interests will find this book to be a useful resource and complete self-study guide. At the same time, the monograph is accessible and will be of use to advanced graduate students and to scientifically trained readers with an interest in the interplay among topology and metric properties and/or functional analysis and metric properties. * coverage of topics applicable to a variety of scientific areas within pure mathematics; * useful techniques and extensive reference material; * includes sharp results in the field of metrization. Professional mathematicians with a wide spectrum of mathematical interests will find this book to be a useful resource and complete self-study guide. At the same time, the monograph is accessible and will be of use to advanced graduate students and to scientifically trained readers with an interest in the interplay among topology and metric properties and/or functional analysis and metric properties. * useful techniques and extensive reference material; * includes sharp results in the field of metrization. Professional mathematicians with a wide spectrum of mathematical interests will find this book to be a useful resource and complete self-study guide. At the same time, the monograph is accessible and will be of use to advanced graduate students and to scientifically trained readers with an

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This contributed volume collects papers based on courses and talks given at the 2017 CIMPA school Harmonic Analysis, Geometric Measure Theory and Applications, which took place at the University of Buenos Aires in August 2017. These articles highlight recent breakthroughs in both harmonic analysis and geometric measure theory, particularly focusing on their impact on image and signal processing. The wide range of expertise present in these articles will help readers contextualize how these breakthroughs have been instrumental in resolving deep theoretical problems. Some topics covered include: Gabor frames Falconer distance problem Hausdorff dimension Sparse inequalities Fractional Brownian motion Fourier analysis in geometric measure theory This volume is ideal for applied and pure mathematicians interested in the areas of image and signal processing. Electrical engineers and statisticians studying these fields will also find this to be a valuable resource.

The chapters of this volume are based on talks given at the eleventh international Sampling Theory and Applications conference held in 2015 at American University in Washington, D.C. The papers highlight state-of-the-art advances and trends in sampling theory and related areas of application, such as signal and image processing. Chapters have been written by prominent mathematicians, applied scientists, and engineers with an expertise in sampling theory. Claude Shannon's 100th birthday is also celebrated, including an introductory essay that highlights Shannon's profound influence on the field. The topics covered include both theory and applications, such as: • Compressed sensing• Non-uniform and wave sampling• A-to-D conversion• Finite rate of innovation• Time-frequency analysis• Operator theory• Mobile sampling issues Sampling: Theory and Applications is ideal for mathematicians, engineers, and applied scientists working in sampling theory or related areas.

This proceedings volume is from the international conference on Banach algebras and their applications held at the University of Alberta (Edmonton). It contains a collection of refereed research papers and high-level expository articles that offer a panorama of Banach algebra theory and its manifold applications. Topics in the book range from K-theory to abstract harmonic analysis to operator theory. It is suitable for graduate students and researchers interested in Banach algebras.

Lectures on Constructive Approximation: Fourier, Spline, and Wavelet Methods on the Real Line, the Sphere, and the Ball focuses on spherical problems as they occur in the geosciences and medical imaging. It comprises the author's lectures on classical approximation methods based on orthogonal polynomials and selected modern tools such as splines and wavelets. Methods for approximating functions on the real line are treated first, as they provide the

foundations for the methods on the sphere and the ball and are useful for the analysis of time-dependent (spherical) problems. The author then examines the transfer of these spherical methods to problems on the ball, such as the modeling of the Earth's or the brain's interior. Specific topics covered include: * the advantages and disadvantages of Fourier, spline, and wavelet methods * theory and numerics of orthogonal polynomials on intervals, spheres, and balls * cubic splines and splines based on reproducing kernels * multiresolution analysis using wavelets and scaling functions This textbook is written for students in mathematics, physics, engineering, and the geosciences who have a basic background in analysis and linear algebra. The work may also be suitable as a self-study resource for researchers in the above-mentioned fields.

The theory of semigroupoids and groupoids makes the transition between arbitrary sets and groups. The usefulness of developing theory stems from various applications where a group structure is lacking, yet there exists some "milder" structure on the set considered. There are numerous applications of semigroupoids/groupoids in: metrization theory, functional analysis, topology, and physics, among others. The material in this thesis is the result of the author's getting acquainted with developments in the theory of semigroupoids/groupoids while reading the recent monograph "Groupoid Metrization Theory With Applications to Analysis on Quasi-Metric Spaces and Functional Analysis" by D. Mitrea, I. Mitrea, M. Mitrea, and S. Monniaux, various parts of which are reproduced in this thesis. In the process, several new avenues are explored for the first time, which contribute to a fuller understanding of this dynamic field.

This book offers a unified presentation of Fourier theory and corresponding algorithms emerging from new developments in function approximation using Fourier methods. It starts

with a detailed discussion of classical Fourier theory to enable readers to grasp the construction and analysis of advanced fast Fourier algorithms introduced in the second part, such as nonequispaced and sparse FFTs in higher dimensions. Lastly, it contains a selection of numerical applications, including recent research results on nonlinear function approximation by exponential sums. The code of most of the presented algorithms is available in the authors' public domain software packages. Students and researchers alike benefit from this unified presentation of Fourier theory and corresponding algorithms.

This book pioneers a nonlinear Fredholm theory in a general class of spaces called polyfolds. The theory generalizes certain aspects of nonlinear analysis and differential geometry, and combines them with a pinch of category theory to incorporate local symmetries. On the differential geometrical side, the book introduces a large class of 'smooth' spaces and bundles which can have locally varying dimensions (finite or infinite-dimensional). These bundles come with an important class of sections, which display properties reminiscent of classical nonlinear Fredholm theory and allow for implicit function theorems. Within this nonlinear analysis framework, a versatile transversality and perturbation theory is developed to also cover equivariant settings. The theory presented in this book was initiated by the authors between 2007-2010, motivated by nonlinear moduli problems in symplectic geometry. Such problems are usually described locally as nonlinear elliptic systems, and they have to be studied up to a notion of isomorphism. This introduces symmetries, since such a system can be isomorphic to itself in different ways. Bubbling-off phenomena are common and have to be completely understood to produce algebraic invariants. This requires a transversality theory for bubbling-off phenomena in the presence of symmetries. Very often, even in concrete applications,

geometric perturbations are not general enough to achieve transversality, and abstract perturbations have to be considered. The theory is already being successfully applied to its intended applications in symplectic geometry, and should find applications to many other areas where partial differential equations, geometry and functional analysis meet. Written by its originators, Polyfold and Fredholm Theory is an authoritative and comprehensive treatise of polyfold theory. It will prove invaluable for researchers studying nonlinear elliptic problems arising in geometric contexts.

Proceedings of the BB Fest 96, a conference held at the University of Cape Town, 15-20 July 1996, on Category Theory and its Applications to Topology, Order and Algebra

The core of this monograph is the development of tools to derive well-posedness results in very general geometric settings for elliptic differential operators. A new generation of Calderón-Zygmund theory is developed for variable coefficient singular integral operators, which turns out to be particularly versatile in dealing with boundary value problems for the Hodge-Laplacian on uniformly rectifiable subdomains of Riemannian manifolds via boundary layer methods. In addition to absolute and relative boundary conditions for differential forms, this monograph treats the Hodge-Laplacian equipped with classical Dirichlet, Neumann, Transmission, Poincaré, and Robin boundary conditions in regular Semmes-Kenig-Toro domains. Lying at the intersection of partial differential equations,

harmonic analysis, and differential geometry, this text is suitable for a wide range of PhD students, researchers, and professionals. Contents: Preface Introduction and Statement of Main Results Geometric Concepts and Tools Harmonic Layer Potentials Associated with the Hodge-de Rham Formalism on UR Domains Harmonic Layer Potentials Associated with the Levi-Civita Connection on UR Domains Dirichlet and Neumann Boundary Value Problems for the Hodge-Laplacian on Regular SKT Domains Fatou Theorems and Integral Representations for the Hodge-Laplacian on Regular SKT Domains Solvability of Boundary Problems for the Hodge-Laplacian in the Hodge-de Rham Formalism Additional Results and Applications Further Tools from Differential Geometry, Harmonic Analysis, Geometric Measure Theory, Functional Analysis, Partial Differential Equations, and Clifford Analysis Bibliography Index

This volume consists of contributions spanning a wide spectrum of harmonic analysis and its applications written by speakers at the February Fourier Talks from 2002 – 2013. Containing cutting-edge results by an impressive array of mathematicians, engineers, and scientists in academia, industry, and government, it will be an excellent reference for graduate students, researchers, and professionals in pure and applied mathematics, physics, and engineering. Topics covered include · spectral analysis and correlation; · radar and

communications: design, theory, and applications; · sparsity · special topics in harmonic analysis. The February Fourier Talks are held annually at the Norbert Wiener Center for Harmonic Analysis and Applications. Located at the University of Maryland, College Park, the Norbert Wiener Center provides a state-of- the-art research venue for the broad emerging area of mathematical engineering.

The aim of the series is to present new and important developments in pure and applied mathematics. Well established in the community over two decades, it offers a large library of mathematics including several important classics. The volumes supply thorough and detailed expositions of the methods and ideas essential to the topics in question. In addition, they convey their relationships to other parts of mathematics. The series is addressed to advanced readers wishing to thoroughly study the topic. Editorial Board Lev Birbrair, Universidade Federal do Ceará, Fortaleza, Brasil Victor P. Maslov, Russian Academy of Sciences, Moscow, Russia Walter D. Neumann, Columbia University, New York, USA Markus J. Pflaum, University of Colorado, Boulder, USA Dierk Schleicher, Jacobs University, Bremen, Germany

In this paper the authors start with the construction of the symplectic field theory (SFT). As a general theory of symplectic invariants, SFT has been outlined in Introduction to symplectic field theory (2000), by Y. Eliashberg, A. Givental and

H. Hofer who have predicted its formal properties. The actual construction of SFT is a hard analytical problem which will be overcome be means of the polyfold theory due to the present authors. The current paper addresses a significant amount of the arising issues and the general theory will be completed in part II of this paper. To illustrate the polyfold theory the authors use the results of the present paper to describe an alternative construction of the Gromov-Witten invariants for general compact symplectic manifolds.

Marking a distinct departure from the perspectives of frame theory and discrete transforms, this book provides a comprehensive mathematical and algorithmic introduction to wavelet theory. As such, it can be used as either a textbook or reference guide. As a textbook for graduate mathematics students and beginning researchers, it offers detailed information on the basic theory of framelets and wavelets, complemented by self-contained elementary proofs, illustrative examples/figures, and supplementary exercises. Further, as an advanced reference guide for experienced researchers and practitioners in mathematics, physics, and engineering, the book addresses in detail a wide range of basic and advanced topics (such as multiwavelets/multiframelets in Sobolev spaces and directional framelets) in wavelet theory, together with systematic mathematical analysis, concrete algorithms, and recent developments in and applications of

framelets and wavelets. Lastly, the book can also be used to teach on or study selected special topics in approximation theory, Fourier analysis, applied harmonic analysis, functional analysis, and wavelet-based signal/image processing.

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