Fractal Geometry and Dynamical Systems in Pure and Applied Mathematics II: Fractals in Applied Mathematics

PISR 2011 International Conference on Analysis, Fractal Geometry, Dynamical Systems and Economics
November 2011: Messina, Sicily, Italy

AMS Special Session on Fractal Geometry in Pure and Applied Mathematics: in Memory of Benoît Mandelbrot
January 2012: Boston, Massachusetts

AMS Special Session on Geometry and Analysis on Fractal Spaces
March 2012: Honolulu, Hawaii

David Carfi
Michel L. Lapidus
Erin P. J. Pearse
Machiel van Frankenhuijsen
Editors

American Mathematical Society
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 Providence, Rhode Island
Contents

Preface vii

Statistical Mechanics and Quantum Fields on Fractals
ERIC AKKERMANS 1

Spectral Algebra of the Chernov and Bogoslovsky Finsler Metric Tensors
VLADIMIR BALAN 23

Local Multifractal Analysis
JULIEN BARRAL, ARNAUD DURAND, STÉPHANE JAFFARD,
and STÉPHANE SEURET 31

Extreme Risk and Fractal Regularity in Finance
LAURENT E. CALVET and ADLAI J. FISHER 65

An Algorithm for Dynamical Games with Fractal-Like Trajectories
DAVID CARFÍ and ANGELA RICCIARDELLO 95

The Landscape of Anderson Localization in a Disordered Medium
MARCEL FILOCHE and SVITLANA MAYBORODA 113

Zeta Functions for Infinite Graphs and Functional Equations
DANIELE GUIDO and TOMMASO ISOLA 123

Vector Analysis on Fractals and Applications
MICHAEL HINZ and ALEXANDER TEPLYAEV 147

Non-Regularly Varying and Non-Periodic Oscillation of the On-Diagonal
Heat Kernels on Self-Similar Fractals
NAOTAKA KAJINO 165

Lattice Effects in the Scaling Limit of the Two-Dimensional
Self-Avoiding Walk
TOM KENNEDY and GREGORY F. LAWLER 195

The Casimir Effect on Laakso Spaces
ROBERT KESLER and BENJAMIN STEINHURST 211

The Decimation Method for Laplacians on Fractals: Spectra and Complex
Dynamics
NISHU LAL and MICHEL L. LAPI DUS 227

The Current State of Fractal Billiards
MICHEL L. LAPI DUS and ROBERT G. NIEMEYER 251
CONTENTS

Long-Range Dependence and the Rank of Decompositions
Céline Lévy-Leduc and Murad S. Taqqu 289

Hitting Probabilities of the Random Covering Sets
Bing Li, Narn-Rueih Shieh, and Yimin Xiao 307

Fractal Oscillations Near the Domain Boundary of Radially Symmetric Solutions of \( p \)-Laplace Equations
Yūki Naito, Mervan Pašić, Satoshi Tanaka, and Darko Žubrinić 325

Applications of the Contraction Mapping Principle
John R. Quinn 345

Economics and Psychology: Perfect Rationality versus Bounded Rationality
Daniele Schilirò 359
Preface

The Contemporary Mathematics volume

*Fractal Geometry and Dynamical Systems in Pure and Applied Mathematics II: Fractals in Applied Mathematics*

contains papers from talks given at three conferences held in 2011–2012, following the passing of Benoît Mandelbrot (widely regarded as the father of fractal geometry) in October of 2010. These meetings are described in chronological order below.

On the occasion of the 2011 Anassilaos International Research Prize in Mathematics, awarded to Michel L. Lapidus (University of California, Riverside), the Permanent International Session of Research Seminars (PISRIS) held its first International Meeting

**PISRIS 2011: Analysis, Fractal Geometry, Dynamical Systems and Economics.**

The conference was held on November 8–12, 2011, at the University of Messina in Sicily, Italy, and was attended by experts in the fields of Fractal Geometry, Dynamical Systems, Number Theory, Noncommutative Geometry, Mathematical and Theoretical Physics, as well as Economics. In addition to approximately 40 experienced researchers participating, the conference included more than 150 students, professors and experts following and attending the meeting. The Award Ceremony for Michel Lapidus took place in Reggio Calabria on Saturday, November 12. The Scientific Committee of PISRIS includes over 50 professors and scholars from more than 25 outstanding universities around the world. It has several branches, including Applied Functional Analysis; Biomathematics; Decision and Game Theory; Differential, Fractal and Noncommutative Geometry; Mathematical Methods of Economics, Finance and Quantum Mechanics; Mathematical Physics and Dynamical Systems. The Chairman of PISRIS is David Carfi.

The 2012 AMS/MAA/SIAM Joint Mathematics National Meeting, held in Boston in January 2012, included an AMS Special Session on “Fractal Geometry in Pure and Applied Mathematics” in memory of Benoît Mandelbrot. Its organizers were Michel Lapidus, Erin Pearse and Machiel van Frankenhuijsen. In five sessions (including sessions comprised of primarily applied topics), researchers from around the world presented their work in various areas of fractal mathematics. An entire session was devoted to the applications to Physics, Biology, Engineering and Computer Science. During one of the breaks, an experiment was performed which demonstrated the capabilities of fractal antennas. Many speakers described ways in which their work was influenced by the work of Benoît Mandelbrot, and a
special dinner was organized in his honor. Several talks were attended by Aliette Mandelbrot, Benoît’s widow, who also gave a short but touching speech.

The Spring 2012 Meeting of the AMS Western Section, held in Honolulu, Hawaii, at the University of Hawai’i at Manoa, included a Special Session on “Geometry and Analysis on Fractal Spaces”. Its organizers were Michel Lapidus, Lü’ Húng, John Rock and Machiel van Frankenhuijsen. In four sessions, researchers from around the world presented their work in various areas of fractal mathematics.

This is a collection of papers on fractal geometry and dynamical systems in applied mathematics and the applications to other sciences. It features articles discussing a variety of connections between these subjects and other fields of science, including physics, engineering, computer science, technology, economics and finance, as well as of mathematics (including probability theory in relation with statistical physics and heat kernel estimates, geometric measure theory, partial differential equations in relation with condensed matter physics, global analysis on nonsmooth spaces, the theory of billiards, harmonic analysis and spectral theory).

These proceedings were conceived as a means of collecting some of the most recent developments in this active area of research, and also to bring together several survey and research expository articles, as a means of introducing new researchers and graduate students to the forefront of the field. The present volume focuses on the more applied aspects of the field, including the applications of fractal geometry and dynamical systems to other sciences. Its companion volume, entitled *Fractal Geometry and Dynamical Systems in Pure and Applied Mathematics I* and subtitled *Fractals in Pure Mathematics*, focuses on the more mathematical aspects of fractal geometry and dynamical systems.

David Carfi,
Michel L. Lapidus,
Erin P. J. Pearse, and
Machiel van Frankenhuijsen.

March 2013

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This volume contains the proceedings from three conferences: the PISRS 2011 International Conference on Analysis, Fractal Geometry, Dynamical Systems and Economics, held November 8–12, 2011 in Messina, Italy; the AMS Special Session on Fractal Geometry in Pure and Applied Mathematics, in memory of Benoit Mandelbrot, held January 4–7, 2012, in Boston, MA; and the AMS Special Session on Geometry and Analysis on Fractal Spaces, held March 3–4, 2012, in Honolulu, HI.

Articles in this volume cover fractal geometry and various aspects of dynamical systems in applied mathematics and the applications to other sciences. Also included are articles discussing a variety of connections between these subjects and various areas of physics, engineering, computer science, technology, economics and finance, as well as of mathematics (including probability theory in relation with statistical physics and heat kernel estimates, geometric measure theory, partial differential equations in relation with condensed matter physics, global analysis on non-smooth spaces, the theory of billiards, harmonic analysis and spectral geometry).

The companion volume (Contemporary Mathematics, Volume 600) focuses on the more mathematical aspects of fractal geometry and dynamical systems.