

Advanced Lectures in Mathematics (ALM)

- ALM 1: Superstring Theory
- ALM 2: Asymptotic Theory in Probability and Statistics with Applications
- ALM 3: Computational Conformal Geometry
- ALM 4: Variational Principles for Discrete Surfaces
- ALM 6: Geometry, Analysis and Topology of Discrete Groups
- ALM 7: Handbook of Geometric Analysis, No. 1
- ALM 8: Recent Developments in Algebra and Related Areas
- ALM 9: Automorphic Forms and the Langlands Program
- ALM 10: Trends in Partial Differential Equations
- ALM 11: Recent Advances in Geometric Analysis
- ALM 12: Cohomology of Groups and Algebraic K-theory
- ALM 13: Handbook of Geometric Analysis, No. 2
- ALM 14: Handbook of Geometric Analysis, No. 3
- ALM 15: An Introduction to Groups and Lattices: Finite Groups and Positive Definite Rational Lattices
- ALM 16: Transformation Groups and Moduli Spaces of Curves
- ALM 17: Geometry and Analysis, No. 1
- ALM 18: Geometry and Analysis, No. 2
- ALM 19: Arithmetic Geometry and Automorphic Forms
- ALM 20: Surveys in Geometric Analysis and Relativity
- ALM 21: Advances in Geometric Analysis
- ALM 22: Differential Geometry: Under the Influence of S.-S. Chern
- ALM 23: Recent Developments in Geometry and Analysis
- ALM 24: Handbook of Moduli, Volume I
- ALM 25: Handbook of Moduli, Volume II
- ALM 26: Handbook of Moduli, Volume III
- ALM 27: Number Theory and Related Areas

Advanced Lectures in Mathematics
Volume XXVII

Number Theory and Related Areas

edited by

Yi Ouyang · Chaoping Xing · Fei Xu · Pu Zhang

 International Press
www.intlpress.com

 高等教育出版社
HIGHER EDUCATION PRESS

Advanced Lectures in Mathematics, Volume XXVII
Number Theory and Related Areas

Volume Editors:

Yi Ouyang (University of Science and Technology of China)

Chaoping Xing (Nanyang Technological University, Singapore)

Fei Xu (Capital Normal University, Beijing)

Pu Zhang (Shanghai Jiao Tong University)

Copyright © 2013 by International Press, Somerville, Massachusetts, U.S.A., and by
Higher Education Press, Beijing, China.

This work is published and sold in China exclusively by Higher Education Press
of China.

All rights reserved. Individual readers of this publication, and non-profit libraries acting
for them, are permitted to make fair use of the material, such as to copy a chapter for use
in teaching or research. Permission is granted to quote brief passages from this
publication in reviews, provided the customary acknowledgement of the source is given.
Republication, systematic copying, or mass reproduction of any material in this
publication is permitted only under license from International Press. Excluded from these
provisions is material in articles to which the author holds the copyright. (If the author
holds copyright, notice of this will be given with the article.) In such cases, requests for
permission to use or reprint should be addressed directly to the author.

ISBN: 978-1-57146-273-2

Printed in the United States of America.

17 16 15 14 13 1 2 3 4 5 6 7 8 9

ADVANCED LECTURES IN MATHEMATICS

Executive Editors

Shing-Tung Yau
Harvard University

Lizhen Ji
University of Michigan, Ann Arbor

Kefeng Liu
University of California at Los Angeles
Zhejiang University
Hangzhou, China

Editorial Board

Chongqing Cheng
Nanjing University
Nanjing, China

Zhong-Ci Shi
Institute of Computational Mathematics
Chinese Academy of Sciences (CAS)
Beijing, China

Zhouping Xin
The Chinese University of Hong Kong
Hong Kong, China

Weiping Zhang
Nankai University
Tianjin, China

Xiping Zhu
Sun Yat-sen University
Guangzhou, China

Tatsien Li
Fudan University
Shanghai, China

Zhiying Wen
Tsinghua University
Beijing, China

Lo Yang
Institute of Mathematics
Chinese Academy of Sciences (CAS)
Beijing, China

Xiangyu Zhou
Institute of Mathematics
Chinese Academy of Sciences (CAS)
Beijing, China

Dedicated to
Professor Keqin Feng

Contents

Binary Additive Counter Stream Ciphers

<i>Cunsheng Ding, Wenpei Si</i>	1
1 Introduction	1
2 Possible attacks and design criteria	3
3 Example 1: the Legendre cipher	9
4 Example 2: the two-prime cipher	14
5 Conclusions and concluding remarks	19
References	21

Partial Difference Sets from Quadratic Forms and p -ary Weakly Regular Bent Functions

<i>Tao Feng, Bin Wen, Qing Xiang, Jianxing Yin</i>	25
1 Introduction	25
2 Partial difference sets from quadratic forms and uniform cyclotomy	30
3 Partial difference sets from weakly regular p -ary bent functions	34
References	39

Governing Fields of the 4-rank of $K_2\mathcal{O}_{\mathbb{Q}(\sqrt{dp})}$ as p Varies

<i>Xuejun Guo, Hourong Qin</i>	41
1 Introduction	41
2 The governing field of the 4-rank of $K_2\mathcal{O}_F$	43
3 The governing field of the 8-rank of $K_2\mathcal{O}_F$	47
References	49

Word-oriented Linear Feedback Shift Registers: σ -LFSRs

<i>Wenbao Han, Xianghui Liu, Guang Zeng, Gangmin Tan</i>	51
1 Introduction	51
2 Model of σ -LFSR	53
3 Cryptographic properties	55
4 σ -LFSRs suitable for software implementation	62
5 Application of σ -LFSRs	65
6 Conclusion	69

Contents

References.....	69
Statistics of Zeros of Families of L-functions over Function Fields:	
A Survey	
<i>Wen-Ching Winnie Li, Maosheng Xiong.....</i>	73
1 Introduction.....	73
2 Hyperelliptic curves.....	75
3 Cyclic l -fold covers of the projective line.....	78
4 Elliptic curves over a rational function field and generalizations....	80
5 Concluding remarks.....	82
References.....	82
Lectures on p-adic Zeta Functions and (φ, Γ)-modules	
<i>Yi Ouyang.....</i>	85
1 Introduction.....	85
2 Continuous functions, measures and distributions over \mathbb{Z}_p	86
3 The p -adic zeta function of Kubota-Leopoldt.....	111
4 (φ, Γ) -modules and Galois cohomology.....	118
5 (φ, Γ) -modules and Iwasawa theory.....	135
References.....	146
Conjectures and Results on $x^2 \bmod p^2$ with $4p = x^2 + dy^2$	
<i>Zhi-Wei Sun.....</i>	149
1 Introduction.....	149
2 Using Apéry polynomials and products of three binomial coefficients.....	160
3 Using the polynomials $S_n(x) = \sum_{k=0}^n \binom{n}{k}^4 x^k$	167
4 Using the function $F_n(x) = \sum_{k=0}^n \binom{n}{k}^3 \binom{2k}{k} x^{-k}$	176
5 Using the function $G_n(x) = \sum_{k=0}^n \binom{n}{k}^2 \binom{2k}{k} \binom{2n-2k}{n-k} x^{-k}$	181
6 Using $a_n(x) = \sum_{k=0}^n \binom{n}{k}^2 \binom{n+k}{k} x^k$	183
7 Miscellaneous things.....	188
References.....	195
Harmonic Weak Maass Forms, Automorphic Green Functions, and Period Integrals	
<i>Tonghai Yang.....</i>	199
1 Introduction.....	199
2 Shimura varieties of orthogonal type and their Kudla cycles.....	203

Contents

3	Harmonic weak Maass forms, regularized theta lifting, and automorphic Green functions	205
4	Eisenstein series associated to coherent and incoherent quadratic spaces	210
5	Period integrals of the automorphic Green function $\Phi(z, h; f)$	213
6	Big CM values of automorphic Green functions.....	218
	References.....	222
	Some Recent Progress in Higher Koszulity	
	<i>Yu Ye, Pu Zhang</i>	225
1	Preliminaries	226
2	Higher Koszulity	227
3	Higher Koszul complexes.....	228
4	Hilbert and Poincaré series.....	230
5	Dual algebras and Ext-algebras	232
6	Generalized d -Koszul modules.....	233
7	Lattice distributivity and Koszulity	234
8	More related topics	236
	References.....	238