

CONTEMPORARY MATHEMATICS

538

Topology of Algebraic Varieties and Singularities

Conference in Honor of Anatoly Libgober's 60th Birthday
June 22–26, 2009
Jaca, Huesca, Spain

José Ignacio Cogolludo-Agustín
Eriko Hironaka
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This volume is a small tribute to Anatoly Libgober's inspiring life-long personal and professional contributions to Mathematics, on the occasion of his sixtieth birthday.



Anatoly Libgober
(photograph courtesy of Brian Libgober)

Contents

Preface	ix
List of Participants	xiii
Part I: A Historical Note	1
Development of the Theory of Alexander Invariants in Algebraic Geometry BY ANATOLY LIBGOBER	3
Part II: Algebraic Geometry and Fundamental Groups	19
Feynman Motives and Deletion-Contraction Relations BY PAOLO ALUFFI AND MATILDE MARCOLLI	21
Classification of Fundamental Groups of Galois Covers of Surfaces of Small Degree Degenerating to Nice Plane Arrangements BY MEIRAV AMRAM, REBECCA LEHMAN, ROBERT SHWARTZ, AND MINA TEICHER	65
Homomorphisms between Kähler groups BY DONU ARAPURA	95
Quasi-Projectivity, Artin-Tits Groups, and Pencil Maps BY ENRIQUE ARTAL-BARTOLO, JOSÉ I. COGOLLUDO-AGUSTÍN, AND DANIEL MATEI	113
Topology of Plane Algebraic Curves: The Algebraic Approach BY ALEX DEGTYAREV	137
Hirzebruch Invariants of Symmetric Products BY LAURENTIU MAXIM AND JÖRG SCHÜRMAN	163
Fundamental Groups, Alexander Invariants, and Cohomology Jumping Loci BY ALEXANDER I. SUCIU	179
Part III: Braids and Knots	225
On Reduction Curves and Garside Properties of Braids BY JUAN GONZÁLEZ-MENESES	227
Topological Quantum Information, Khovanov Homology and the Jones Polynomial BY LOUIS H. KAUFFMAN	245
HOMFLYPT Skein Module of Singular Links BY LUIS PARIS	265

Part IV: Hyperplane Arrangements	277
First Milnor Cohomology of Hyperplane Arrangements BY NERO BUDUR, ALEXANDRU DIMCA, AND MORIHIKO SAITO	279
Minimal CW-complexes for Complements to Line Arrangements via Discrete Morse Theory BY GIOVANNI GAIFFI, F. MORI, AND M. SALVETTI	293
The Topology of Hyperplane Arrangements BY RICHARD RANDELL	309
Part V: Singularities	319
On ν -Quasi-Ordinary Power Series: Factorization, Newton Trees and Resultants BY E. ARTAL-BARTOLO, PI. CASSOU-NOGUÈS, I. LUENGO, AND A. MELLE-HERNÁNDEZ	321
Milnor Fibrations for Real and Complex Singularities BY JOSÉ LUIS. CISNEROS-MOLINA, JOSÉ SEADE, AND JAWAD SNOUSSI	345
On Homotopy Types of Complements of Analytic Sets and Milnor Fibres BY JAVIER FERNÁNDEZ DE BOBADILLA	363
The Milnor Fiber Signature is not Semicontinuous BY DMITRY KERNER AND ANDRÁS NÉMETHI	369
Principal Analytic Link Theory in Homology Sphere Links BY A. NÉMETHI, WALTER D. NEUMANN, AND A. PICHON	377
On Mixed Brieskorn Variety BY MUTSUO OKA	389
Introduction to Jung's Method of Resolution of Singularities BY PATRICK POPESCU-PAMPU	401
Biggest Sharp Polynomial Estimate of Integral Points in Right-Angled Simplices BY STEPHEN S.-T. YAU, LINDA ZHAO, AND HUAIQING ZUO	433

Preface

The present volume is a collection of surveys and research papers written by invitation or based on plenary talks given at the conference on “Topology of Algebraic Varieties”, held in Jaca, Spain from the 22nd to the 26th of June, 2009. It presents the contemporary status of a variety of topological problems in algebraic geometry on the borderline between the singularity theory, knot theory and combinatorics. The Jaca’s meeting took place on the occasion of Anatoly Libgober 60th birthday.

In addition to the plenary talks, the conference also had short communications and poster sessions, which are not included here, but which contributed significantly to the wide range of topics covered during the intense week-long meeting.

This volume consists of four parts corresponding to the specific aspects on which the conference was focused: Algebraic Geometry and Fundamental Groups, Braids and Knots, Arrangements and Singularities.

There were more than 150 participants at this meeting and the list of invited participants included major contributors in Algebraic Geometry and Singularity theory and past collaborators of Anatoly’s such as Heisuke Hironaka, Le Dung Trang, Donu Arapura, Tatyana Bandman, Denis Chéniot, Alexandru Dimca, Steven Sperber, John Wood, Stephen S.-T Yau, and Sergey Yuzvinsky.

The unifying themes of A. Libgober work are the Topology of Algebraic Varieties and Singularity theory.

A. Libgober was born in Moscow in the former Soviet Union on March 24, 1949. He attended Moscow University from 1964 until 1970. He studied algebraic geometry with Yu. I Manin and I.I. Piatetski-Shapiro. A. Libgober applied to emigrate to Israel in 1971, was denied permission but after active protests was allowed to leave in June 1973. He wrote his Ph.D. dissertation at Tel-Aviv University under B. Moishezon in 1977. After spending one year at the Institute for Advanced Studies at Princeton he became Assistant Professor at the University of Illinois at Chicago Circle (later renamed to University of Illinois at Chicago). He was named Professor in 1988. During his tenure he returned several times to the Institute for Advanced Study, the Institute des Hautes Études Scientifiques (Bures sur Yvette), the Max Planck Institute (Bonn, Germany), and the MSRI (Berkeley). He visited Harvard University (1982) and Columbia University (1987-88). He lectured extensively in USA, Israel, Germany, France, Spain, and Japan. His Ph.D. students thus far are S. Giallomas (1986), J.I. Cogolludo (1999), N. Krylov (2002), and V. Egorin (2004). He also informally advised E. Hironaka during her work on Ph.D. dissertation and was PostDoc mentor for L. Maxim and R. Waelder.

A. Libgober’s thesis “Topology of algebraic hypersurfaces” studied the problem of identifying the type of smooth algebraic hypersurfaces in projective space

as differentiable or topological manifolds. This problem attracted much attention in the case of complex surfaces. However, the higher-dimensional case requires completely different approaches. His calculation of the Kervaire invariant of hypersurfaces provided a link between topology and singularity theory. Later, continuing his work jointly with J. Wood, he showed the existence of diffeomorphic complete intersections of different multi-degrees in dimension greater than two. A few years later A. Libgober started the study of Alexander invariants of the complement to plane algebraic curves and used methods of knot theory and low-dimensional topology for the study of these complements. He proved his divisibility theorem relating the fundamental group of the complements to the type of singularities of the curve. He also found a description of the homotopy type of the complements to plane affine singular curves, gave restrictions on the groups which can appear as the fundamental groups of the complements to plane algebraic curves, developed the multivariable version of Alexander invariants, and developed the use of the Hodge theoretical methods for these problems. This paved the way to the revival of this area of algebraic geometry in the last twenty years. Since then the theory developed in a vast subject of Alexander invariants of quasi-projective varieties and found its applications in the theory of arrangements, topology of plane singular curves, study of Kähler groups, etc. In the early 90's his joint work with J. Teitelbaum expanded the scope of the spectacular description by physicists such as P. Candelas, X. de la Ossa, P. Font, or L. Parkes on mirror symmetry of quintic hypersurfaces giving the orbifold construction of these mirror partners of Calabi-Yau complete intersections (about the same time L. Borisov-V. Batyrev developed the theory of mirror duality for complete intersection, extending V. Batyrev's mirror duality). A. Libgober continued his work on mathematical foundations of new at the time ideas from physics in series of joint works with Lev Borisov introducing notion of elliptic genus for singular algebraic varieties. This theory of the elliptic genus of varieties \mathbf{Q} -Gorenstein singularities, orbifolds, real algebraic varieties and in particular McKay correspondence for elliptic genus, found connections with homotopy theory, vertex operator algebras, modular forms and the moonshine.

Sponsors of Jaca's conference include the National Science Foundation (NSF), the Spanish Ministerio de Ciencia e Innovación, the Clay Mathematics Institute, the local Government of Aragón (DGA), the Program Ingenio Mathematica by the Spanish Mathematics Institute, the Red Española de Topología (RET), the Universities of Illinois (UIC) and Zaragoza (UZ), and the American (AMS), European (EMS), and Spanish (RSME) Mathematical Societies have turned this event into a milestone for this area of mathematics.

This meeting would have not been possible without the dedication shown by the Organizing Committee: José Ignacio Cogolludo, Vladimir Egorin, Eriko Hironaka, Alejandro Melle, Mina Teicher, and Domingo Toledo. The Scientific Committee, formed by Ignacio Luengo, Norbert A'Campo, Victor Batyrev, Joan Birman, Laurence Ein, and José María Montesinos, made a special effort to find a representative list of speakers that could attempt to cover the many subjects Anatoly Libgober has

contributed to, and that share an interest in Singularity Theory and the Topology of Algebraic Varieties.

José Ignacio Cogolludo-Agustín
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