Vincenzo Galgano

Curriculum Vitae

Contact Information

Birth 16/08/1993, in Taranto, Italy

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Education

2016/17–present **Graduate student in Pure Mathematics**, *Università di Pisa*, Pisa.

2012/13–2015/16 **Bachelor student in Pure Mathematics**, *Università di Pisa*, Pisa.
Bachelor Degree in Mathematics, 98/110, 16/12/2016.

2007/08–2011/12 **High School student**, *Liceo Classico "Giuseppe Moscati"*, Grottaglie (TA).
High School Diploma, *100/100 cum laude*, July 2012.

Thesis

Master I'm currently working on my master thesis under the supervision of Professor Giorgio Ottaviani of the *Università di Firenze*. I'm interested in the tensor decomposition of complete intersections of projective quadrics. In this work I'm learning about tensor rank decomposition and secant varieties.

Bachelor **Title:** *Teoria di Galois su superfici di Riemann: rivestimenti ramificati e algebre étale* (eng: *Galois theory on Riemann surfaces: ramified coverings and étale algebras*)
Advisor: Professor Marco Franciosi
Description: Following Adrien Douady's approach, we introduce a generalization of the classical Galois Theory, due to Grothendieck, through étale algebra and we show a categorical antiequivalence between the category of finite analytical ramified coverings of a compact connected Rimeann surface and the category of étale algebra over its meromorphic functions field. This antiequivalence allows us to link the Grothendieck Galois Theory to the Covering Theory. In particular we analyze the case of compact connected Riemann surfaces: looking at them as finite analytical ramified coverings of the Riemann sphere, they are (anti)equivalent to the field extensions with trascendence degree 1 over $\mathbb{C}$. Thanks to this classication, we are able to calculate the absolute Galois group of the field $\mathbb{C}(Z)$.

Conferences

March 30, 2017- -April 1, 2017 **AAA - Algebraic Algorithms and Applications**, *Department of Mathematics*, Pisa.
I attended the open conference about an historic overview on computational algebra from 1965 to 2025, organized at the occasion of the 65th birthday of Professor Patrizia Gianni.

Experience

September 9-13, 2019 **Part-time Tutor (Supporto alla didattica)**, *Department of Agricultural Science*, Pisa.
I won a competition for a tutor position. My job was to hold a thrirty-hours-a-week debt recovery course in mathematics for first-year students, by teaching basic mathematical concepts through theory and exercises. Moreover I prepared the final recovery test. This experience was different from the previous ones due to the many hours concentrated in just one week.

January 2019- -May 2019 **Part-time Tutor (Supporto alla didattica)**, *Department of Biology*, Pisa.
I renewed the previous collaboration with Prof.ssa Paola Cerrai. My job was to show to the first-year students how to approach to the exercises given by the teacher in class, recalling the theory behind them.

September 2018- -December 2018 **Part-time Tutor (Supporto alla didattica)**, *Department of Biology*, Pisa.
I won a competition announcement to begin a collaboration with the university. My job was to assist Prof.ssa Paola Cerrai in a debt recovery course in mathematics for first-year students, by teaching basic mathematical concepts through theory and exercises. Moreover I collaborated to the preparation of the final recovery test. This experience helped me a lot in understanding the problems of teaching and gave me motivation to improve both as a student and as a teacher.

September 2018- -November 2018 **Part-time Tutor (Supporto alla didattica)**, *Department of Mathematics*, Pisa.
I won a competition announcement to begin a collaboration with the university. My first job was to tutor other students (especially first-year students), by assisting them with their queries and problems. My second job was to cooperate with other students in the organization of events promoted by the Department.

September 2017- -December 2017 **Part-time Tutor (Supporto alla didattica)**, *Department of Biomedical Engineering*, Pisa.
I won a competition announcement to begin a collaboration with the university. My job was to assist Prof. Nicola Visciglia in the first-year course *Algebra lineare e Analisi matematica 2*, especially by supervising students during their exams.

February 2016- -October 2016 **Part-time Counseling (Counseling)**, *Department of Mathematics*, Pisa.
I won a competition announcement to begin a collaboration with the university. My job was to conceive and write a brochure to promote the university's educational offer to high-school students.

Skills

Language skills

Italian Mother tongue
English Fluent - First Certificate in English (FCE), 2009
French Basic - Delf A1, 2006

Computer skills

Matlab Intermediate
LaTeX Intermediate
C Language Basic

Graduate Coursework and Main Contents

- **Elements in Complex Analysis** (30/30 *cum laude*)
- **Algebraic Geometry C** (30/30 *cum laude*)
- **Numerical Analysis** (in Pisa: "Istituzioni di,") (27/30)
- **Differential Geometry and Topology** (28/30)
- **Geometry** (in Pisa: "Istituzioni di,") (30/30 *cum laude*)
- **Algebra** (in Pisa: "Istituzioni di,") (28/30)
- **Numerical Methods for Markov Chains** (26/30)
- **Algebraic Number Theory 1** (30/30)
- **Optimization Theory and Methods** (30/30)
- **Elements in Algebraic Topology** (30/30 *cum laude*)
- **Coding Theory and Cryptography** (28/30)
- **Algebraic Geometry B** (30/30 *cum laude*)
- **Computational Algebra A** (30/30 *cum laude*)

Other exams in my study plan that I'm currently studying for:

- **Lie Groups and Lie Algebras**

Seminars I have held for exams:

- *Separating functions on compact Riemann surfaces* (Elements in Complex Analysis)
- *Castelnuovo-Mumford regularity* (Algebraic Geometry C)
- *Abelian complex tori* (Algebraic Geometry B)
- *Error bounds for QBD approximation of a two-dimensional reflecting random walk* (Numerical Methods for Markov Chains)
- *A mixed integer programming problem in cryptography* (Optimization Theory and Methods)

Main Graduate Contents

Algebra Integral extensions (normal domains, lying over, going-up, going-down), Dimension Theory (Noether normalization, artinian rings, 1-dimensional normal rings, Krull hauptidealsatz, regular rings); Vector bundles and $H^1(X, GL(n))$, projective modules, locally-free modules, K-forms of L-algebras, $H^1(\Gamma, G)$ and Hilbert 90; Abelian ategories, cohomology of complexes (long exact sequence, injective resolutions, projective resolutions), derived functors (Ext, Tor, long exact sequence); Group homology and cohomology (H^2 for the abelian case), inflation, (co)iduction, cyclic cases, (co)restriction; Central simple algebras (splitting over Galois extensions), Brauer group; Brauer group of $\mathbb{F}_q((t))$.
Galois theory (finite and infinite); Ring of integers of number fields, integral basis, Dedekind domains, fractional ideal group, ideal class group, unique ideal factorization in DD; Ramification index and inertia degree of prime ideals, the case of Galois extensions, Kummer theorem on splitting of primes, decomposition group, inertia group, unramified extensions, totally ramified extensions, Frobenius automorphism for unramified primes, discriminant of extensions; finiteness of the ideal class group, Minkowski constant, finiteness of number fields with fixed discriminant, Dirichlet's unit theorem.

Applied Algebra Polynomial Multiplication via FFT and FFI, modern GCD in $\mathbb{Z}[x]$, Polynomial Factorization (Berlekamp algorithm, Hensel lifting of solutions, Mignotte bounds), Simple Algebraic Extensions (computation of minimal polynomials and splitting fields), Dimension Theory on $\mathbb{K}[x_1, \ldots, x_n]$ (Noether Normalization, computation of dimension of ideals, 0-dimensional ideals, structure of Groebner basis), Primary Decomposition (computation), Resolution of Polynomial Systems (Groebner basis in general position, eigenvalues of multiplication matrices, Stickelberger theorem), LLL-reduction for lattices and application to factorization in $\mathbb{Q}[x]$.
Complexity over $\mathbb{Z}$, GCD, Karatsuba algorithm, complexity over $\mathbb{Z}/n\mathbb{Z}$, Cipolla algorithm, Tonelli-Shanks algorithm, square roots $\mod n$ and factorization of n, quadratic reciprocity, primality tests (Solovay-Strassen, Miller-Rabin).
Linear codes, maximum likelihood decoding, dual codes, Hamming codes, generator and parity matrices, inequalities for codes, ciclic codes, Reed-Solomon codes, BCH-codes, Goppa codes, decoding (locator polynomial, key equation).
Cryptographic protocols, cipher, signature, public and private key, RSA, Diffie-Hellmann, El-Gamal, authentication and Fiat-Shamir; Factorization over $\mathbb{Z}$ (Pollard's ρ, Fermat critetion, quadratic sieve, number fields sieve (NFS)); discrete logarithm (baby-step-giant-step, Pollard's ρ, Pohlig-Hellmann, factor basis); elliptic curves and factorization; lattices, smallest vector problem, closest vector problem, LLL-reducted basis, Babai algorithms; post-quantum cryptography, NTRU and lattices, hidden field equation (HFE) and Groebner basis, Mc-Eliece and Goppa codes.

Geometry Smooth varieties, tangent spaces, immersions, embeddings, vector bundles, tangent bundles, tensor bundles, vector fileds, Lie brackets, foliations, tubular neighborhood, homotopy and isotopy, trasversality, Whitney embedding; Differential forms, Stokes theorem, de Rham cohomology, Mayer-Vietoris sequence, Poincaré duality, Kunneth theorem; Riemannian varieties, connections over bundles, covariant derivative, parallel transport, Levi-Civita connection, geodetics, exponential map, Gauss lemma, Hopf-Rinow theorem, Riemannian curvatures, Ricci curvature, flat varieties.
Singular homology, CW-complexes, cellular homology, homotopy groups, cellular approximation, cohomology ring, cup product, Poincaré duality.
Sheaves cohomology, Cech cohomology, complex varieties, line bundles, divisors, Picard group, projective immersion, Kodaira vanishing and Kodaira embedding.
Riemann surfaces, singularity resolution via blow up, genus of compact connected orientable surfaces, Riemann surfaces of genus 1, holomorphic and meromorphic functions, Hurwitz formula, group action on a Riemann surface; GAGA principle, invertible sheaves, linear systems of divisors and correspondence with projective maps, canonical divisor, Riemann-Hurwitz theorem, Remann-Roch theorem, base-point-free linear systems, very ample divisors, projective embeddings of Riemann surfaces, Chow theore, equivalence between the category of Riemann surfaces and the category of extensions of $\mathbb{C}$ with trascendence degree 1, Mittag-Leffer problem, hyperelliptic curves, Clifford theorem, periods map and jacobian varieties, Abel-Jacobi map, Abel theorem, Jacobi inversion theorem.

Numerical Analysis	Ortogonal polynomials (zeros, properties, Christoffel-Darboux, discrete ortogonality), Courant-Fischer theorem, moment matrices (LU factorization), Chebyshev polynomials; Approximation of integrals, interpolatory formulas for integration, Newton-Cotes formulas, Cavalieri-Simpson method; Linear approximation; Polynomial interpolation and splines (convergence property, minimal curvature property, B-splines); Minimax approximation (Chebyshev equioscillation, convergence), quasi-minimax approximation; Numerical methods for resolution of PDEs, maximun principle method, stability in infinite norm, Neumann bound conditions, stability and convergence in norm 2 and infinite norm, eigenvalues problem and Bauer-Fike theorem; Numerical testings. Markov chains, transition matrices; non-negative matrices, Perron-Frobenius theorem, M-matrices; models in queue theory, M/G/1 and G/M/1 problems, quasi-birth-death processes (QBD), Ramaswami formula.

Areas of Interest

Applied Algebra	Finite Fields, Algebraic Cryptography, Computational Algebra
Algebra	Commutative Algebra, Global-Local Correspondences, Grothendieck's Galois Theory
Geometry	Secant Varieties, Tensor Decomposition, Applied Algebraic Geometry