

**Maurizio Monge**  
*Curriculum vitæ (as of September 13, 2013)*

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CITIZENSHIP      Italy

BIRTH              Date: October 15, 1981  
                      Place: Cuneo (CN, Italy).

POSITION           Postdoctoral student at the Instituto de Matemática of the Universidade Federal do Rio de Janeiro (UFRJ), starting from September 1, 2013.

EDUCATION        Ph.D. in Mathematics (*Diploma di Perfezionamento*)

- institute: Scuola Normale Superiore of Pisa
- date: March 5, 2012.
- vote: 70/70 *cum laude*.
- thesis title: ‘*A constructive theory for extensions of  $p$ -adic fields*’.
- supervisor: Prof. R. Dvornicich.

Master Degree in Mathematics (*Laurea vecchio ordinamento*)

- institute: University of Pisa
- date: September 26, 2008.
- vote: 110/110 *cum laude*.
- thesis title (italian): ‘*Funzioni simmetriche e polinomi di Newton*’
- thesis title (english): ‘*Symmetric functions and Newton polynomials*’
- supervisor: Prof. R. Dvornicich.

High school

- institute: Liceo Scientifico G.Peano of Cuneo (Italy).
- period: from *September 1994* - to *July 2000*
- vote: 98/100

- M. Monge, **Generation of the symmetric field by Newton polynomials in prime characteristic**, *published in Rocky Mountains Journal (2012)*.

It was proved by Dvornicich-Zannier that the polynomials  $x^a + y^a$ ,  $x^b + y^b$ ,  $x^c + y^c$  generate the field of symmetric function in  $x, y$  over  $\mathbb{Q}$ , when  $a, b, c$  have no common factor. We extend the result in prime characteristic  $p$ , under the additional hypothesis that  $a, b, c$ , and their pairwise differences, are all prime with  $p$ . The additional hypotheses are proved to be necessary with a family of counterexamples.

Links: <http://arxiv.org/abs/0903.3192>,  
<http://projecteuclid.org/euclid.rmjm/1335187175>

- N. Dubbini, M. Monge, **An equivalent of Kronecker's Theorem for powers of an algebraic number and structure of linear recurrences of fixed length**, *published in Acta Arithmetica (2012)*.

Let  $\alpha$  be an algebraic number and  $m$  a fixed integer. Given  $m$  real numbers  $x_1, \dots, x_m$ , we estimate about how well we can simultaneously approximate modulo 1 each  $x_i$  by  $t\alpha^i$ , for some real  $t$ . The best possible approximation is related to the Mahler measure of  $\alpha$ , and the estimate is proved to be best-possible up to a constant. During the proof we obtain a result of independent interest on the existence of a special basis of the module of linear recurrences of fixed length over the  $p$ -adic integers  $\mathbb{Z}_p$ .

Links: <http://arxiv.org/abs/0910.5182>,  
<http://journals.impan.gov.pl/aa/Inf/153-1-2.html>

- M. Monge, **On perfect hashing of numbers with sparse digit representation via multiplication by a constant**, *published in Applied Discrete Mathematics (2010)*.

Small note on a hashing technique, consisting in mapping the information contained in numbers formed by sparse non-zero digits into consecutive digits, via multiplication by a constant number. An estimate on the length of the interval of consecutive digits necessary to do this is obtained.

Links: <http://arxiv.org/abs/1003.3196>,  
<http://www.sciencedirect.com/science/article/pii/S0166218X11000837>

- M. Monge, **Determination of the number of isomorphism classes of extensions of a  $p$ -adic field**, *published in Journal of Number Theory (2010)*.

We solve the problem of enumerate isomorphism classes of extensions of a  $p$ -adic field. A combinatorial lemma allows to solve the problem in full generality, reducing the computation to Krasner Formula, which counts all extensions in the algebraic closure, and the computation of cyclic extensions, which can be obtained via local class field theory.

Links: <http://arxiv.org/abs/1011.0357>,  
<http://www.sciencedirect.com/science/article/pii/S0022314X11000758>

- A. Cobbe and M. Monge, **Answer to a question on  $A$ -groups, arisen from the study of Steinitz classes**, *submitted (2011)*.

We show that the families of solvable  $A$ -groups and  $A'$ -groups are different, with a counterexample which is already too big to be found via an exhaustive search. They had been conjectured to be equal in A. Cobbe's thesis. We prove that the conjecture is true when only two primes divide the order of the group. The conjecture on Steinitz classes is shown to be verified for the counterexamples provided.

Link: <http://arxiv.org/abs/1109.2065>

- M. Monge, **A characterization of Eisenstein polynomials generating cyclic extensions of degree  $p^2$  and  $p^3$  over an unramified  $p$ -adic field**, *accepted with minor revision to Journal de Théorie des Nombres de Bordeaux (2013)*.

We show a quite general technique to derive necessary and sufficient conditions on the coefficients of a polynomial, for it to have a prescribed Galois group. We can recover easily Lbekkouri's criterion for polynomials of degree  $p^2$  generating a cyclic extension, generalizing it to fields that are unramified extensions of the rational  $p$ -adic field  $\mathbb{Q}_p$ .

When some hypothesis is not satisfied, we show that the first unsatisfied hypothesis in the list gives information about the Galois group of the normal closure. Exploiting this information we can give a complete description of polynomials of degree  $p^2$  whose splitting field is a  $p$ -extension.

We apply the same methods to give necessary and sufficient conditions on coefficients of polynomials of degree  $p^3$  to generate a cyclic extension, the conditions are quite complicated, but can be derived in a relatively straightforward way.

Link: <http://arxiv.org/abs/1109.4616>

- M. Monge, **A family of Eisenstein polynomials generating totally ramified extensions, identification of extensions and construction of class fields**, *accepted with minor revision to International Journal of Number Theory (2013)*.

We present a family of special polynomials generating totally ramified extensions of local field  $K$ . We prove that each extension is generated by at least a special polynomial, but the number of special polynomials generating one extension  $L$  is at most the number of conjugates of  $L/K$  in the algebraic closure, and in particular it is unique for Galois extensions. A reduction algorithm is presented, and its study allows to characterize the set of special polynomials in terms of the intermediate extensions. A characterization of Eisenstein polynomials of degree  $p$  generating a Galois extensions is obtained topologically.

A criterion that can ensure that two polynomials generate non-isomorphic extensions is provided. The criterion is particularly effective when a polynomial is known to generate a Galois extension, and does not only depend on the first-order value of the difference of the polynomials evaluated on a uniformizing element.

We describe an algorithm which allows to construct a totally ramified class field, given a suitable description of a norm subgroup. A constructive proof of the Existence Theorem of local class field theory is obtained, constructing a unique extension with prescribed norm group and degree equal to the index, which can also be easily shown to be Galois.

Link: <http://arxiv.org/abs/1109.4617>

PUBLICATIONS  
AND PREPRINTS  
(OTHER TOPICS)

- [ENGINEERING, CONTROL THEORY] N. Dubbini, M. Monge and A. Bicchi, **Left invertibility of I/O quantized linear systems in dimension 1: a number theoretic approach**, *preprint (2009)*.
- [COMPUTER SCIENCE, COMPLEXITY THEORY] M. Monge and G. Viglietta, **The 3-dimensional searchlight scheduling problem**, *presented at Canadian Conference on Computational Geometry (2010)*.
- [ENGINEERING, NLP] G. Fantoni, R. Apreda, F. Dell’Orletta, M. Monge, **Automatic extraction of function-behaviour-state information from patents**, *published in Advanced Engineering Informatics (2013)*.

SCHOOLS AND  
CONFERENCES

- 150 years of Riemann Hypothesis (*April 19-24, 2009; Verbania*)
- Italy-India Conference on Diophantine and Analytic Number Theory (*March 08-14, 2010; Pisa*)
- Field Arithmetic (*June 13-17, 2010; Tel-Aviv*)
- School and Conference on Modular Forms and Mock Modular Forms and their Applications in Arithmetic, Geometry and Physics (*February 28-March 12, 2011; Trieste*)
- Progrès récents en théorie des modules galoisiens (*March 21-25, 2011; Luminy*)
- The Birch and Swinnerton-Dyer Conjecture Summer School (*June 26-July 3, 2011; Alghero*)
- Continued Fractions, Interval Exchanges and Applications to Geometry (*June 11-14, 2013; Pisa*)
- Workshop on Combinatorics, Number Theory and Dynamical Systems (*August 19-23, 2013; Rio de Janeiro*)

SEMINARS AND  
POSTERS

- *(November 30, 2009)* Doctoral seminar at Scuola Normale Superiore of Pisa, with title: “Un equivalente del teorema di Kronecker per potenze di un numero algebrico e struttura delle ricorrenze lineari di lunghezza fissata”,
- *(November 24, 2010)* Doctoral seminar at Scuola Normale Superiore of Pisa, with title: “Enumerazione e formule di massa per estensioni di campi p-adici”,
- *(May 24, 2011)* Doctoral seminar at IMB of Bordeaux, with title: “Enumeration and classification of extensions of p-adic fields”,
- *(May 30, 2011)* Seminar at the University of Limoges, with title: “Enumeration and classification of extensions of p-adic fields”,
- *(October 21, 2011)* Seminar at IRMAR of Rennes, with title: “Polynômes d’Eisenstein spéciaux engendrant les extensions totalement ramifiées, identification des extensions et réalisation des corps de classes”,
- *(November 8, 2011)* Doctoral seminar at IMB of Bordeaux, with title: “Hachage des nombres formés de chiffres dispersés à travers la multiplication par une constante”,
- *(November 23, 2011)* Doctoral seminar at Scuola Normale Superiore of Pisa, with title: “Polinomi di Eisenstein speciali che generano le estensioni totalmente ramificate, identificazione delle estensioni e costruzione dei corpi di classe”.
- *(July 19, 2013)* Seminar at Graz University of Technology, with title: “On the failure of Kronecker’s density theorem for powers of an algebraic number”.
- *(August 21, 2013)* Poster at Workshop on Combinatorics, Number Theory and Dynamical Systems at IMPA, with title: “On the failure of Kronecker’s density theorem for powers of an algebraic number”.

VISITS

- *(from May 9 - to May 30, 2011)* At IMB of Bordeaux.
- *(from October 3 - to December 31, 2011)* At IMB of Bordeaux.
- *(from August 2 - to September 30, 2013)* At Universidade Federal do Rio de Janeiro (Attending the Thematic Semester “Dynamics Beyond Uniform Hyperbolicity” at IMPA).

ORGANIZATION

- *(2010 to 2012)* Organized the seminar of Ph.D. students at Scuola Normale Superiore of Pisa.
- *(2011 to 2012)* Collaborated with the organizing committee of Italian Olympiads of Mathematics in problem selection, and worked as problem corrector at Cesenatico’s competition.

- TEACHING
- (*from October 1, 2008 - to June 30, 2011*): done weekly mentoring for first and second year students at Scuola Normale Superiore.
  - (*February 3-4, 2011*): held stage for Italian Olympiads of Mathematics at Taranto
  - (*July 22-28, 2011*): done tutoring, with problems sessions and seminars for the stage organized by Scuola Normale Superiore for high-school students at Camigliatello Silano.
  - (*February 27, 2012 - to June 27, 2012*): teaching assistant for the course of Analysis and Linear Algebra for students in Biomedical Engineering of the University of Pisa, with Profs. S. Galatolo and C. Bonanno.
  - (*November, 2012 - July, 2013*): teaching assistant for the course of Analysis and Linear Algebra for students in Civil Engineering of the University of Pisa, with Profs. S. Galatolo and C. Carminati.
- JOB EXPERIENCE
- (*From April, 2012 - to now*): collaborator as applied researcher in natural language processing and information extraction for Erre Quadro Srl (*up to September, 2012*) and Dipartimento delle Energie e dei Sistemi at the University of Pisa (*starting from October, 2012*) for the regional project “Lilit” (Living Labs per l’Industria Toscana), financed by Tuscany.
- AWARDS AND SCHOLARSHIPS
- Undergraduate scholarship (Studente Ordinario) at Scuola Normale Superiore of Pisa, from *October 2000 - to November 2004* (admission vote: 9.3/10).
  - (*April 2000*) classified 25th at the Italian Olympiads of Mathematics.
  - (*April 2000*) classified as one of the ten winners of the Italian Olympiads of Physics.
- OTHER SKILLS
- Experience with the Axiom, GAP, MAGMA and Sage computer algebra systems.
- COMPUTER SCIENCE
- Natural Language Processing (NLP) and related tools (stemming, POS-tagging, dependency parsing, statistical analysis of texts, extraction of information, latent semantic analysis).
  - Machine Learning and Optimization, Bayes inference, neural networks, support vector machines, maximal entropy models.
- PROGRAMMING LANGUAGES
- Proficient: C/C++, Java, Python, Ruby, Javascript, Scala.
  - Experience with PHP, Haskell, OCaml, MySQL.

AWARDS IN  
COMPUTER  
SCIENCE

- (*2006*) classified as winner of the 19th edition of IOCCC, the International Obfuscated C Code Contest.

LANGUAGES

- Italian (mother language)
- English (fluent)
- French (very good)
- Portuguese (good)