# BELGIAN MATHEMATICAL SOCIETY

Comité National de Mathématique    CNM

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NCW    Nationaal Comite voor Wiskunde

## BMS-NCM NEWS

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No 75, November 15, 2009

## *Letter from the editor*



> *Welcome*
> *to our **"November 15, 2009-Newsletter"**!*
> *Have a nice December; see you next year!*
>
> *Françoise*

# Contents

# 1  News from the BMS

No PhD-day is scheduled in 2009... but we can already announce that **the next PhD-day** of the BMS will take place in Brussels on **Monday September 13, 2010.** More informations will be availbale in the forthcoming Newsletters!

# 2  Meetings, Conferences, Lectures

## 2.1  November 2009

### Geometric Properties of Musical Rhythms

### Perouz Taslakian, department of Computer Science, ULB

Day: 27/11/2009, Time: 2 pm - 3 pm
Place: Room A106, building A, Salesianenlaan 30, 2660 Hoboken (department IWT, Karel de Grote-Hogeschool)
Contact: rudi.penne@kdg.be For more information, see also the announcement at the end of this Newsletter.

Abstract: In this talk, we will present a collection of results in computational geometry that are inspired from music theory literature. Our results are based on a representation of a musical rhythm where pulses are viewed as points equally spaced around the circumference of a circle and onsets are a subset of the pulses. We will study some rhythmic properties and show connections to different areas such as neutron accelerators in nuclear physics, and an ancient algorithm for computing the greatest common divisor of two numbers, originally described by Euclid around 300 BC.

## 2.2  December 2009

### Anglo-Belgian Workshop in Model Theory and Applications

### University of Mons, December 2-3, 2009

For more information, see http://w3.umh.ac.be/math/logic/UK-CFB.html

### Courbes elliptiques: un problème du millénium

### Don Zagier
### Professeur au Collège de France et co-directeur de l'Institut Max Planck de mathématique de Bonn
### Jeudi 3 décembre 2009, 19 heures à l'ULB

This is a PUBLIC LECTURE - open to all.
It will take place on December 3, 2009, 19:00, ULB, bâtiment S, Avenue Jeanne 44, 1050 Bruxelles, rez de chaussée

### Ondelettes et Sciences du Vivant

### Gembloux, December 3-4, 2009

For more information, see the announcement at the end of this Newsletter.

### FNRS Contact Group "Wavelets and applications"

Dear Colleagues,
The next meeting of our Contact Group will take place in Gembloux (Agro-Bio Tech, Ex Faculté des sciences agronomiques) on

Friday December 4, 2009.

Our list of speakers will include Valérie Perrier (Grenoble), Peter Balasz (Vienna), Patrice Brault (Supelec Paris) and Aleksandra Pizurica (Ghent).

As usual, we have time for a couple of shorter talks and we welcome your proposals before November 20.

Please send a mail to register to demol@ulb.ac.be at your earliest convenience but preferably not later than November 25.

Looking forward to seeing you soon,
With best regards,                                                  Jean-Pierre Antoine and Christine De Mol

### Joint meeting of the Belgian and London Mathematical Societies
### December 4-5, 2009

A joint meeting of the BMS and LMS will be held in Leuven on December 4 and 5, 2009. During this meeting, the Lucien Godeaux lecture will be given by Cédric Villani (ENS Lyon).

Other plenary speakers: I.K. Capdeboscq (Warwick), T. De Medts (Gent), P. van Moerbeke (U.C.Louvain), J. Tanner (Edinburgh)

Special sections: algebraic geometry and cryptography, logic, differential equations and dynamical systems, scientific computing and mathematical modelling, Hopf algebras and quantum groups, groups and geometry, statistics, random matrices

All information, including a registration form, is available on

http://www.cs.kuleuven.be/conference/BLMS2009/

See also the poster at the end of this Newsletter.

### Banach spaces with the Daugavet property
### D. Werner, Freie Un. Berlin

### December 10, 2009, University of Mons

For more information, please see the announcement at the end of this Newsletter.

## 3   PhD theses

UNIVERSITY ANTWERP
Title: A Contribution to the Reliable Evaluation of Mathematical Functions
Name: Franky Backeljauw
Supervisor: Annie Cuyt
Date: 23 september 2009

K.U.LEUVEN/KORTRIJK
Title: Vastepuntstheorie en coïncidentietheorie voor infra-nilvariëteiten
Name: Pieter Penninckx
Supervisor: Karel Dekimpe
Date: 7 december 2009

UNIVERSITY OF LIÈGE
Title: Abstract Numeration Systems: Recognizability, Decidability, $S$-automatic Multidimensional Words, and Real Numbers
Name: Emilie Charlier
Supervisor: Michel Rigo
Date: December 7, 2009, 14:30; amphi 01, Institut de Mathématique (B37), 4000 Liège (Sart-Tilman)

Abstract Numeration Systems:
Recognizability, Decidability, *S*-automatic Multidimensional Words, and Real Numbers
*Emilie Charlier, December 7, 2009, University of Liège*

Abstract numeration systems were introduced in 2001 by P. Lecomte and M. Rigo [6]. This new way to represent numbers generalizes that of usual positional numeration systems. Some standard properties are preserved in this wider framework though some others are not. Yet, the advantages of these systems stem from their great generality: current research on this subject strives to highlight the properties that are independent of the target numeration system, such as properties related to the complexity of the numeration language. In this dissertation we study and we solve several questions regarding abstract numeration systems. Each particular problem is the focus of a chapter.

The first problem concerns the study of the preservation of recognizability under multiplication by a constant in abstract numeration systems built on polynomial regular languages. We prove that, for systems built on an alphabet containing more than two letters, multiplication by a constant never preserves recognizability. We also obtain structural properties of bounded languages. In particular, we propose a characterization of recognizable sets in terms of semi-linear sets of $\mathbb{N}^\ell$, where $\ell$ is the number of letters of the target abstract numeration system. We also study the action of multiplication by a constant on any word in the numeration language.

The second problem we consider is a decidability problem, which was already studied, most notably, by J. Honkala [5] and A. Muchnik [7], provided that addition is recognizable, *i.e.*, that its graph is regular. For our part, we propose decision procedures for two new cases. The first procedure handles positional numeration systems in which $\mathbb{N}$ is recognizable, satisfying certain relatively weak conditions. In particular, we incorporate systems for which addition is not recognizable. We focus on the number of residue classes $N_U(m)$ visited infinitely often by the reduced sequence $(U_i \bmod m)_{i \geq 0}$, where $U = (U_i)_{i \geq 0}$ is a linear recurrence sequence of integers. If $U$ is the basis of the numeration system, our decision procedure requires the condition $\lim_{m \to +\infty} N_U(m) = +\infty$. In a separate section, involving $p$-adic number theory, we give an algebraic characterization of linear recurrence sequences $U$ satisfying this condition. With similar hypotheses, we then propose a second decision procedure in the case of abstract numeration systems. In particular, in both cases, we highlight several examples that had not been resolved until now.

Next, we focus on the extension to the multidimensional setting of a result of A. Maes and M. Rigo regarding automatic sequences extended to abstract numeration systems. In this case one refers to *S-automatic* sequences. In his doctoral dissertation, A. Maes had introduced the definition of *shape-symmetric* multidimensional words. Generalizing results from [4, 8, 9, 10], we prove that, in the multidimensional case, the *S*-automatic words correspond to the images by a coding of shape-symmetric pure morphic words. An essential point of the proof of this theorem is to generalize the standard result in the unidimensional case (for instance, see [2]) according to which any word obtained by erasing all occurrences of a fixed letter from a morphic word is either finite or morphic.

Finally, we concentrate on the representation of real numbers in the general framework of abstract numeration systems extended to any languages, *i.e.*, to languages which are not necessarily regular. The aim of this study was to provide a unified approach to several numeration systems encountered in the literature. For example, the rational base numeration systems recently introduced in [1] give rise to non-context-free numeration languages. We construct, under certain general hypotheses on the numeration language, a formalism for the representation of the real numbers by infinite words, which are limits of words in the numeration language. We then illustrate this formalism thanks to three examples of abstract numeration systems built on non-regular languages.

We end by a list of open questions in the continuation of the present work.

# References

[1] S. Akiyama, Ch. Frougny, and J. Sakarovitch, Powers of rationals modulo 1 and rational base number systems, *Israel J. Math. 168* (2008), 53–91.

[2] J.-P. Allouche and J. Shallit, *Automatic sequences. theory, applications, generalizations*, Cambridge University Press, Cambridge", 2003.

[3] A. Cobham, On the Hartmanis-Staerns problem for a class of tag machines, *IEEE Conference Record of 1968 Ninth Annual Symposium on Switching and Automata Theory*, IEEE Computer Society (1968), 51–60.

[4] A. Cobham, Uniform tag sequences, *Math. Systems Theory* **6** (1972), 164–192.

[5] J. Honkala, A decision method for the recognizability of sets defined by number systems, *RAIRO Inform. Theor. Appl.* **20** (1986), 395–403.

[6]  P.B.A. Lecomte, M. Rigo, Numeration systems on a regular language, *Theory Comput. Syst.* **34** (2001), 27–44.

[7]  An. A. Muchnick, The definable criterion for definability in Presburger arithmetic and its applications, *Theoret. Comput. Sci.*, **290** (2003), 1433–1444.

[8]  M. Rigo, Generalization of automatic sequences for numeration systems on a regular language, *Theoret. Comput. Sci.* **244** (2000) 271–281.

[9]  M. Rigo and A. Maes, More on generalized automatic sequences, *J. Autom., Lang. and Comb.* **7** (2002), 351–376.

[10]  O. Salon, Suites automatiques à multi-indices et algébricité, *C. R. Acad. Sci. Paris Sér. I Math.* **305** (1987), 501–504.

# 4    Miscellaneous

## 4.1    From UCL

Un poste académique en Mathématique (Géométrie et Physique Mathématique), entrée en fonction en septembre 2010, est vacant au département de mathématique de l'UCL.

Pour de plus amples informations, voir http://www.uclouvain.be/287221.html

## 4.2    Message from French Math Societies

About Ibni Prize, please have a look at the adresses

http://www.cimpa-icpam.org/spip.php?article281, http://smf.emath.fr/en/SouscriptionSaleh/.

# 5    History, maths and art, fiction, jokes, quotations. . .

**Goldman's Theorem** Ron J. Stern, Saga Books, 2008, 220 p., ISBN: 9781897512227.
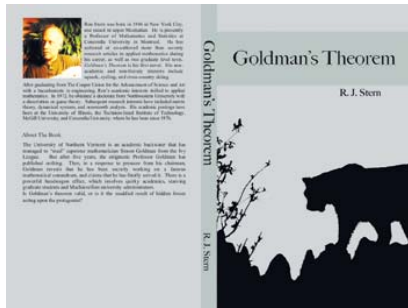
If you don't know this novel and you know the theorem of Goldman (since such a theorem really exists), forget about the theorem and read the novel. So much more fun! This is about some fictitious Simon Goldman who cracks one of the millennium problems and proves the P = NP conjecture. As is well known, P stands for the set of problems of size $n$ that can be solved in a time that is bounded by a polynomial in $n$. I.e., they are "easy" to compute. Some problems however require so much time to solve that it would be impossible to ever build a computer in the whole universe that could solve the problem ever. Nevertheless, given a solution of the problem, it might be fairly easy to check that it is indeed a solution. That is an NP problem. So the P vs. NP problem is in fact proving that there do or do not exist problems that are "impossible to solve" but "easy to check". It was originally formulated independently by Stephen Cook and Leonid Levin in 1971 and it has been nominated as one of the seven millennium prize problems by the Clay Mathematical Institute[1] of Cambridge in the year 2000. Each problem is worth one million US dollars. Thus solving this problem would be headline news worldwide like Andrew Wiles proving Fermat's Last Theorem was.

Back to fiction now. Ron Stern, a New Yorker, born in 1946, is currently a professor of mathematics and statistics at Concordia University in Montreal. This is his first novel. It is at the same time hilarious and deeply tragic. The scene is the small "backwater" University of Northern Vermont, near the New York border. Simon Goldman was a young, highly promising mathematician, that had been attracted to the math department using some keen and strategic academic politics orchestrated by his friend Herman Melvin 'Aitch' Singleton (the names 'Gold-man', 'Singleton', etc. are not accidental). So he manoeuvred Goldman into getting the prestigious Von Essen endowment (yes, indeed Prussian aristocrats distributing the money to whoever has the 'right German attitude'), which is a very comfortable research position. Stern gives a sharp insightful sketch of university relations and he describes the hidden agendas and the political courtship dances with a lot of humor introducing quite colorful caricature-like characters. There is the "twin" Nathan Finkelstein and Ibrahim Ibrahim, one is a Zionist Jew, the other a Muslim supporter of the Palestinian cause, both PhD students working somewhere in the dungeons of the department and doing all the slave-work their supervisors do not have time for, and a Chinese student running a take-away restaurant form his room. But most of all there are the academic characters. The chairman Guillermo Slutnick, who is using at least one 'to-be-bleeped-away'-adverb with every noun. Vito de Bernardo is a cycling fanatic with an outspoken preference for Italian cyclist culture. He is in charge of 'Il Gruppo', a cycling group, and leads them like a Mussolini on exhausting tours that are more like survival missions. Margaret Fulton is the dean and a true administrator. She is usually referred to as the Virgin Queen and has a background in British history making her think, behave, and reign like Queen Elisabeth I. Aitch Singleton has an eye on the young assistant professor Celestine Sauvage, but gets a cougar in his backyard (see cover design) who becomes good friends with his cat New-

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[1]For more details about the seven millennium prize problems, see `www.claymath.org/millennium/`.

ton. The hilarious situations that Stern describes are of course exaggerated, but nevertheless (unfortunately) quite recognizable. They made me laugh out loud more than once.

When after five years, Goldman has completely disappeared into inertia, not publishing, not going to conferences, colleagues start wondering what is happening, afraid that he is turning into 'deadwood' after all. So, under some pressure, because an evaluation is coming up (and others have to justify them 'stealing away' Goldman five years ago) Goldman tells his friend Singleton that he has 'hit the jackpot', and discovered the 'Holy Grail'. He is just checking the details, but he is almost sure to have solved the above mentioned millennium problem. Some colleague checks the result, and after a local seminar, the word is spread quickly and the whole media circus is brought into position. The department, faculty, and even the whole university is trying to get the best out of this success story. Even the hundred year old Horst Von Essen is invited to the official presentation of that result.

One more key role is for Izzy Fleck, a 'lounge-lizard' fleeing his physics department where 'nobody is interested in mathematical physics'. He hangs around, trying to catch up with string theory (if he isn't falling asleep). So, almost by accident he attends the lecture by Goldman, after which he gets interested in the subject and detects the flaw in the proof which makes the whole argument implode. The usual 'it is obvious that' quote, that nobody had doubted so far, turned out to be not true.

After that the novel takes a much more dramatic turn. Goldman disappears from the campus, and Vito and Singleton go in search for their friend in Vito's Maserati. When Goldman is finally found in New York in the neighborhood where he spent his youth, it becomes clear that he had suffered all these years from a traumatic Vietnam experience. But it would not be an American novel, if there wasn't a happy ending. Goldman returns, now that he is relieved from this haunting experience, and he resumes his work. His proof was actually just a near-mis, and therefore did advance the research in finding the solution.

The reader does not have to know mathematics, although there is some mathematics going on: the 'traveling salesman problem' is used to explain the P vs. NP problem extensively, but along the road, some other topics have a minor role like spherical coordinates, non-smooth analysis, and the geometry of affine cones. Some of the gags may probably be better understood if you know some mathematics.

So if you want a good laugh, you should read the book. If you are deeply involved in university administration or academic politics, you should only read it when you don't take yourself too seriously.

P.S. There has been a poll about P vs. NP problem what people think about it, whether it could be solved or not, and with what techniques. Some well known people have some remarkable answers to it. For example Donald Knuth predicts that it will be finally solved with a $P = NP$ result in either 2048 or 4096, and Dana Nau says that she has found a wonderful and simple proof that $P \neq NP$, but that it unfortunately does not fit into the margin of an e-mail. You can read about the poll at `www.cs.umd.edu/~gasarch/papers/poll.pdf`.

Adhemar Bultheel

# Joint Meeting of the

# Belgian Mathematical Society & London Mathematical Society

## Leuven, December 4-5, 2009

**Plenary speakers:**

- Marianna Csörnyei
- Tom De Medts
- Jared Tanner
- Pierre van Moerbeke
- Cédric Villani
  (*Godeaux Lecture*)

**Parallel sessions:**

- Algebraic Geometry and Cryptography
- Differential Equations and Dynamical Systems
- Groups and Geometry
- Hopf algebras and quantum groups
- Logic
- Random Matrices
- Scientific Computing and Mathematical Modelling
- Statistics



**Scientific Committee:**

Françoise Bastin
Stefaan Caenepeel
Brian Davies
Catherine Finet
Stephen Huggett
Walter Van Assche

**Local organizers:**

Walter Van Assche
Stefaan Vaes
Adhemar Bultheel
Joos Vandewalle
Joelke Vandoren

**For more information and online registration, please visit**:

http://www.cs.kuleuven.be/conference/BLMS2009/
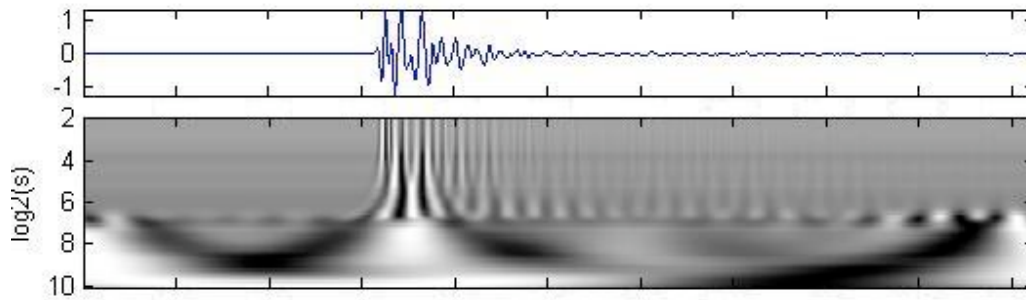
Dans le cadre du 150ème anniversaire de la Faculté universitaire
des Sciences agronomiques de Gembloux,
l'Unité de Statistique Informatique et Mathématique appliquées
et le groupe de contact FNRS « Ondelettes et applications »
organisent une conférence sur le thème

# « Ondelettes et Sciences du Vivant »

3 et 4 décembre 2009

ULg – Gembloux Agro-Bio Tech
Auditoire PhV, bâtiment de Biologie végétale
Entrée : avenue Maréchal Juin – 5030 Gembloux
(Parking possible à l'espace Senghor, avenue de la Faculté)

**Programme**

## 3 décembre – Première approche sur les ondelettes appliquées aux Sciences du vivant

9h30 Cours introductif sur les ondelettes et leurs applications
C. Charles, SIMa, Gembloux Agro-Bio Tech, ULg

14h00 Conférences sur les applications des ondelettes aux Sciences du Vivant
S. Nicolay, Département de Mathématiques, ULg
*Détection des origines des réplications dans les génomes mammifères à l'aide de la transformée en ondelettes*

A. Arneodo, ENS-Lyon
*Organisation du génome humain en relation avec la réplication et la structure chromatinienne*

L. Jacques, Communications and Remote Sensing Laboratory, UCL
*Débruitage d'images par ondelettes et graphes non-locaux*

A. Deckmyn, Royal Meteorological Institute
*Atmospheric data assimilation using complex wavelets*

## 4 décembre – Journée du groupe de contact FNRS « Ondelettes et applications »

9h45 Accueil

10h00 Conférences sur les applications des ondelettes
V. Perrier, Laboratoire Jean Kunztmann, Grenoble
P. Balasz, Austrian Academy of Sciences, Vienne
P. Brault, Laboratory of Signals and Systems, Supélec, Paris
A. Pizurica, Telecommunications and Information Processing, Ghent University

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# "Geometric Properties of Musical Rhythms

**Perouz Taslakian**

**(department of Computer Science, ULB)**

Friday 27I11I2009
2 pm-3 pm
Room A106, building A,
Salesianenlaan 30, 2660 Hoboken
(department IWT, Karel de Grote-Hogeschool)

Contact rudi.penne@kdg.be

**Catherine Finet**
**Karl Grosse-Erdmann**

**Service d'Analyse Mathématique**
**Service de Probabilités et Statistique**

# INSTITUT DE MATHEMATIQUE

## Ecole doctorale thématique

## LE JEUDI 10 DECEMBRE 2009
## DE 15h15 à 16h30
**Université de Mons**
**Le Pentagone, Local 3C09**
**Avenue du Champ de Mars, 6**
**7000 Mons - Belgique**

# Dirk WERNER

## Professeur à la Freie Universität Berlin, Allemagne

## « Banach spaces with the Daugavet property »

**INVITATION CORDIALE A TOUS**