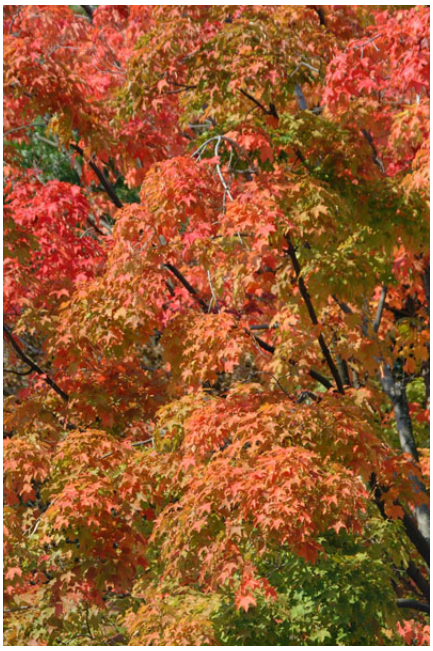

BELGIAN MATHEMATICAL SOCIETY

Comité National de Mathématique CNM

C W M
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NCW Nationaal Comite voor Wiskunde

BMS-NCM NEWS: the Newsletter of the Belgian Mathematical Society and the National Committee for Mathematics

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BMS-NCM NEWS

No 55, November 15, 2005

Letter from the editor

Welcome to the November 15-Issue of our Newsletter!

Well, I have no special story to tell you... Halloween is already over and was particularly nice this year with its typical colours enhanced by the marvelous and blazing ones of the sunny forest ... Yes, I am found of this season ...

I already wish you a happy New Year (the next issue of the Newsletter is only(?) scheduled for January 15 ...)

Françoise Bastin

Contents

1 Last News from the PhD-Day, September 12, 2005

Recall that three awards were offered, for the three best posters. Two of them were already included in the previous issue of the Newsletter (De Schepper, U. Gent and De Wispelaere, U. Gent). Bougard's (ULB) poster is included at the end of this issue.

2 Meetings, Conferences, Lectures

2.1 December 2005

Réunion du Groupe de contact FNRS
Logique mathématique
1-2 décembre 2005

Les conférenciers invités sont P. Aczel (Manchester), T.Forster (Cambridge), M. Forti (Pise) et S. Tupailo (Tallin). Le programme complet et les informations pratiques sont sur http://math.umh.ac.be/logic/seminars.htm

C. Michaux

2.2 January 2006

55th European Study Group Mathematics with Industry (SWI2006), Eindhoven.

The 55th European Study Group Mathematics with Industry (ESGI55 or SWI2006) will be held at the Technische Universiteit Eindhoven from January 30 to February 3, 2006. We would like to invite you to participate.

For more than thirty years, the Study Group Mathematics with Industry has brought together mathematicians and companies. Following the original Oxford model, about 60 mathematicians, ranging from PhD students to professors, spend a week working on one of the six real life problems, presented to them on Monday morning. During four busy days these problems are discussed, dissected, modelled, analysed, and computed through, and results are presented on Friday. We are still in the process of selecting the problems; please consult the website for details. We anticipate that a wide range of mathematical expertise is needed to contribute to solving these problems. This includes differential equations, numerical analysis, probability theory, statistics, graph theory, optimisation and much more.

Examples of problems from the past years include:
- the behaviour of a droplet of polymer solution in an ink-jet printer (Philips);
- quality forecasting of flight schedules (KLM);
- the diffusion of euro coins in the euro zone.

If you enjoy applying your mathematical skills to problems from the world outside academia, please visit the website for more information and register at: http://www.win.tue.nl/swi2006/

Participation is free. Limited funding is available to cover hotel costs.

We hope to see you at the study group in Eindhoven,
the organising committee.
(Erik Fledderus, Remco van der Hofstad, Ellen Jochemsz, Jaap Molenaar, Tim Mussche, Mark Peletier and Georg Prokert.)

2.3 May 2006

CANT'2006 International School and Conference
on Combinatorics, Automata and Number Theory
Belgium, University of Liège, Department of Mathematics
May 8-19, 2006

See the poster at the end of this Newsletter.

Organising Committee: V. Berthé (CNRS, Montpellier), M. Rigo, P. Lecomte (Liège).

Location: Institute of Mathematics, University of Liège, Belgium.
Information: e-mail: M.Rigo@ulg.ac.be
Web site: http://www.cant2006.ulg.ac.be

2.4 2008

See the annoucement (poster) at the end of this Newsletter:

5ECM, July 14-18, 2008
5th EUROPEAN CONGRESS of MATHEMATICS

3 Summary of PhD theses

Cédric RIVIERE, UMH
Promoteur: Christian Michaux
Défense: 30 septembre 2005

Model-companions of theories of differential fields. Differential cell decomposition in closed ordered differential fields

The body of this work is divided in two distinct parts. The first part consists in the construction of a general method to axiomatize "geometrically" the model companion of theories of differential fields. For this, we generalize the work of D.Pierce and A.Pillay in the case of the theory of differentially closed fields of characteristic zero. The word "geometrically" refers to the fact that we use usual notions of algebraic geometry (variety, tangent space, torsor, ...). We introduce a notion of "large" topological differential fields (of characteristic zero) and then give a general scheme of axioms for any model companion of a theory of large topological differential fields. This construction generalizes the one introduced by Pierce and Pillay and applies to the case of the theory CODF of closed ordered differential fields. The second part (and the most important one) is dedicated to the study of definable sets in the theory CODF of closed ordered differential fields. Our approach here is to develop an analog of o-minimality in this differential context. The most powerful tool in the study of o-minimal theories is a theorem of cell decomposition proved by J.Knight, A.Pillay and C.Steinhorn in the 80's. Thus, our first task in Chapter 2 is to define an appropriate notion of differential cell (called d-cell) in CODF. A basic result for this is the density of all the jet-spaces in their ambient space (this is proved in the more general case of topological differential theories in Chapter 1). Even if these d-cells do not behave as well as their o-min-imal analogs, they share quite a lot of interesting properties with them. In particular we can define a notion of dimension (called d-dimension) on d-cells which, as in the o-minimal case, resumes to summing 1 and 0.Using d-cells we then prove a differential cell decomposition theorem (called d-decomposition theorem) which generalizes the usual theorem of cell decomposition in o-minimal structures. In particular, this theorem allows us to extend the definition of the d-dimension to any definable set in CODF. This d-dimension is a dimension function in the sense of the axioms given par L. van den Dries and is "equivalent" to the differential transcendence degree of a generic point and to the topological dimension associated, in this case, to a "natural" differential topology called d-topology. The rest of Chapter 2 contains further developments linked to this d-decomposition theorem: for example we define, on the definable sets in CODF, a notion of dimension which is finer than the d-dimension. We called it the K-rank and show that it is extremely close to the notion of dimensional polynomial in differential algebra introduced by E.R.Kolchin. We also give a partial result of decomposition of definable sets into connected components. We end this thesis with two short appendices. The first one begins with an algebraic axiomatization for the theory of closed ordered partial differential fields (i.e. the fields are equipped with finitely many commuting derivations) and a brief explanation about the generalization of the work in Chapter 2 (i.e. the construction of a differential analog of o-minimality) to this more complicated case. The second appendix contains the proof of the existence (and an axiomatization) of the model-companion of the theory of differential fields equipped with finitely many orders.

Qianlu LI, UMH
Promoteur: Françoise Point
Défense: 30 septembre 2005

Criteria for a group to be nilpotent-by-finite exponent.

Our aim is to find conditions under which, in certain classes of groups, a group is nilpotent-by-finite-exponent (almost nilpotent). We shall give two criterions for groups to be almost nilpotent in a very large class S of groups which includes all residually or locally finite groups and all residually or locally soluble groups. For any word in the free group F we investigate its image under general homomorphisms. Using this, we associate with any

word a number, that we call standard exponent. We show that any group in S is almost nilpotent if and only if its standard exponent is 1. Since the class of the words whose standard exponents are 1 contains all positive words, all words which determine Milnor identities, and all efficient words, this result generalizes the following result: any residually finite group or any soluble group generated by finitely many elements satisfying a finite disjunction of Milnor identities is almost nilpotent (F. Point in 1996) and the result: any residually finite group satisfying an identity defined by a word which is efficient or which has an efficient result is almost nilpotent (S. Black in 1999).In addition, our method gives a very simple way to calculate the standard exponent of a word. Let F(x1,...,xn) (respectively F(c,d)) be the free group freely generated by x1,...,xn (respectively by c, d). We just apply the general homomorphisms from F(x1,...,xn) to F(c,d) sending xi ® fi.dki, where fi is a product of conjugates of c by powers of d and ki is an integer and then we can directly write out the standard exponent of the word. Second, we consider f- Milnor groups, where f is a polynomial. In another way, not using group laws, we deduce a criterion for groups to be almost nilpotent: any f-Milnor group in the class S is almost nilpotent if and only if the coefficients of the polynomial f are coprime.

Nicolas GUZY, UMH
Promoteur: Christian Michaux et Françoise Point
Défense publique: 07 décembre 2005 à 15h30, à la salle Marie Curie, Bâtiment Les Grands Amphithéâtres

Model-theoretical properties on p-convexly valued rings and on existentially closed differential topological fields.

This thesis divides into two parts. Each part is a rewritten version of several papers accepted or submittted.

The first part deals with tools related to the theory of p-valued fields, namely p-valuations on fields, p-adically closed fields, Kochen operator and Kochen ring over a p-adically closed field.

In the two first chapters of my thesis, we develop a p-adic counterpart of the two following theories: real closed valuation rings and real-series closed fields.

The first chapter, entitled "p-convexly valued rings", is an extended version of one of our recently published paper, which is a based on the work by M. Dickmann about real closed valuation rings. First we deal with a notion of p-convexity and transpose the work by T. Becker on convexly ordered valuation rings to our p-adic setting. In particular, we characterize the integral definite polynomials in several variables over a p-adically closed integral ring (which is the p-adic analogue of real closed valuation ring). Then we define the concepts of p-adic ideal and p-adic radical of a p-adically closed integral ring in order to prove a Nullstellensatz theorem and finish the comparison with the real case by introducing a model-theoretic radical. It allows us to show that this model-theoretic notion coincides with the classical algebraic one.

The second chapter, "entitled henselian residually p-adically closed fields" comes from a submitted paper. We consider p-valued fields equipped with a valuation v compatible with the given p-valuation. We will use this compatibility property of the valuations to study our p-adic counterpart of real-series closed fields, namely henselian residually p-adically closed fields, which is the class of models of Th(K((t))) where K is a p-adically closed field. The point of view of this chapter is more algebraic since we are inspired by the work of A. Srhir about p-adic ideals and p-adic Nullstellensatz. First, we solve a Hilbert's Seventeenth problem for these fields. Then we introduce the notions of residually p-adic ideal and residually p-adic radical of an ideal in the ring of polynomials in n indeterminates over a henselian residually p-adically closed field.

The second part deals with topological differential fields. In a first step, we study the existence of a model companion or a model completion under some technical conditions for classes of differential topological fields where there is no interaction between the topology and the derivation (it is a joint work with Françoise Point). More precisely, we are given an inductive theory of differential topological fields which has a model completion or a model companion. We expand the language with a new unary function symbol which satisifies the axioms of a derivation then we consider the following question: when the corresponding expansion of the theory retain the property of having a model completion (respectively a model companion). Under some topological conditions, we write down a topological scheme of axioms (DL) which gives the model companion of these differential topological fields theories. Moreover, this topological general framework will allow us to solve the problem of axiomatizing the model companion of differential topological fields by using the technology of varieties like in the fomalism of D. Pierce and A. Pillay for the geometric first-order axiomatization of differentially closed fields. Then we specialize the previous work to the case of differential valued fields. We exploit the scheme of axioms (DL) which allows us to establish the model companion (or model completion) results to the valued field case in order to obtain important model-theoretic results. It allows us to prove a differential version of Ax-Kochen-Ersov theorem in an existentially closed form and to give several examples of differential valued

field theories which admit a model completion. As a byproduct, we prove the positive answer for Hilbert's Seventeenth problem for the differential analogue of the theory of p-adically closed fields of p-rank d. Another important result is a differential valued analogue of the theorem proved by M.F. Singer concerning a differential analogue of Artin's Theorem for real closed fields .

In the second chapter, we only deal with differential valued fields (so the topology is the valuation topology which specialize our previous considerations for differential topological fields). We consider valued fields equipped with several commuting derivations and study the same kind of questions which were stated in the work of M. Tressl about differential large fields and were studied in the previous chapter (in the work of N. Guzy and F. Point). We choose to use the same approach as in the work of M. Tressl, i.e. we treat algebraically the problem by identifying some systems of differential polynomials with specific properties (these systems are called algebraically prepared).

In the last chapter, we deal with valued fields equipped with a derivation which satisfies a strong continuity condition (framework introduced by T. Scanlon) and reprove a result of quantifier elimination for these differential valued fields in the language introduced by F. Delon in her thesis. This language is more adapted to the algebraic applications like in the solution of Hilbert's Seventeenth problems for classical theories of differential valued fields.

Jean-Michel PAPY, K.U. Leuven, ESAT-SCD
Promotors: Sabine Van Huffel, Lieven De Lathauwer, Martine Wevers
Defended on October 3, 2005

Subspace-based exponential data fitting using linear and multilinear algebra

The exponentially damped sinusoidal (EDS) model arises in numerous signal processing applications. It is therefore of great interest to have methods able to estimate the parameters of such a model in the single-channel as well as in the multi-channel case. Because such a model naturally lends itself to subspace representation, powerful matrix approaches like HTLS in the single-channel case, HTLSstack in the multi-channel case and HTLSDstack in the decimative case have been developed to estimate the parameters of the underlying EDS model. They basically consist in stacking the signal in Hankel (single-channel) or block Hankel (multi-channel) data matrices. Then, the signal subspace is estimated by means of the singular value decomposition (SVD). The parameters of the model, namely the amplitudes, the phases, the damping factors, and the frequencies, are estimated from this subspace. Note that the sample covariance matrix counterpart is called TLS-ESPRIT, multi-channel TLS-ESPRIT and decimative TLS-ESPRIT. In these methods, the order of the model (i.e. the number of damped sinusoids) is assumed to be known. A variety of methods for estimating the model order exists. The recently developed method ESTER has been shown to outperform the existing Information Theoretic Criteria (ITC) based techniques. ESTER relies on the shift invariance property of the signal subspace. We propose an easy-to-implement SVD-based method which also exploits the same shift invariance property and outperforms the method ESTER. As far as multi-channel signals are concerned, it may be of great interest to extract only the common sinusoids. This may be for instance the case in Electroencephalogram (EEG) monitoring or material health monitoring. So far, only techniques which extract the common damped sinusoids in the two-channel case have been described. We propose a flexible and accurate method that can be applied to an arbitrary number of channels. The last part of the thesis deals with multilinear algebra, which is the algebra of higher-order tensors. Higher-order tensors can be seen as higher dimensional tables than can be addressed with more than two indices. First, we show that the matrix approaches do not exploit all the structure which is present in the theoretical decomposition. This is especially true in the multi-channel and the decimative case. In a second step we demonstrate that a higher-order representation of the problem may help to take this structure into account. We derive the higher-order counterparts of the HTLS, HTLSstack and HTLSDstack methods for estimating the parameters of an EDS model, and show by means of a higher-order dimensionality reduction algorithm that the estimation of the signal subspace, and hence the parameters of the EDS model, may be more accurate than the one obtained via the matrix approaches.

4 Miscellaneous

4.1 Call for contributions

SIAM is launching a call for a contribution to a website, see

http://www.whydomath.org

For more information on SIAM, see the pages at the address

http://www.siam.org/news

4.2 From UMH

Le séminaire interuniversitaire de **logique mathématique** tient ses séances hebdomadaires le jeudi à 11h et à 14h30; le programme est disponible sur

http://math.umh.ac.be/logic/seminars.htm

4.3 From ULB

Prof. Cheryl Praeger,
Doctor Honoris Causa of the Faculty of Science of the ULB
November 16, 2005

On November 16th, 2005, the Université Libre de Bruxelles and its Faculties will award Doctor Honoris Causa Degrees to people whose achievements in their respective fields have made them models for the future generations.

On that occasion, Professor Cheryl Praeger (University of Western Australia) will be awarded a Doctor Honoris Causa Degree from the Faculty of Science.

Cheryl Praeger is Professor of Mathematics at the University of Western Australia. Her research focuses on finite groups, their actions in combinatorial and geometric settings, including algorithmic aspects. The hallmark of her work is the use of deep group theoretic methods, including the simple group classification, to solve algebraic and combinatorial problems. Her publications include more than 240 journal articles and 3 books. She was profiled in 2004 in the ISI "Highly Cited Researchers" website (http://www.isihighlycited.com/) as one of the top 0.5% of researchers in the mathematical sciences. Praeger's research was acknowledged by election as a Fellow of the Australian Academy of Science, appointment as a Member of the Order of Australia, and award of an honorary doctor of science degree from the Prince of Songkla University, Thailand.

For further information, please contact Dimitri Leemans.

Philippe Cara (pcara@vub.ac.be) and
Dimitri Leemans (dleemans@ulb.ac.be)

4.4 From KUL

For more information concerning what follows, see the address http://www.kuleuven.be/admin/rd/niv3p/vzap6/adj02wet.htm

22/2018 Classical Analysis
(starting 1.10.2006)

The Faculty of Science has an opening for a **full time position at the Department of Mathematics in classical mathematical analysis,** starting October 1, 2006. The successful candidate will become part of the section of mathematical analysis and is expected to carry out strong and innovative research in collaboration with the existing team. At present the focus of the classical analysis team is on asymptotics, special functions, random matrices and approximation theory.

The candidate is expected to have research expertise in at least one relevant aspect of classical analysis and additional expertise in some other fields, such as functional analysis, numerical analysis, asymptotic analysis or mathematical physics, is appreciated. High quality of research should be apparent from publications in international journals. International experience is desired.

The candidate is expected to participate in teaching activities in mathematics at different levels in the university, both in Leuven and at the campus in Kortrijk, and has to be committed to excellence in teaching. In general, the language of instruction is Dutch, but some activities may be offered in English. Foreign speakers are expected to teach their courses in Dutch after two years.

This position requires a Ph.D. or doctoral degree in sciences. The appointment will be made at a level consistent with the experience and qualifications of the candidate.

The Faculty of Science is an equal opportunity employer.

22/2019 Mathematics for Space Weather
(starting 1.10.2006)

The Department of Mathematics of the Faculty of Sciences of the K.U.Leuven is seeking applicants to fill a **full time position in Mathematics for Space Weather starting 1 October 2006.**

The position is being offered to work in the research group "Plasma Astrophysics" where the focus is on Space and Astrophysical Fluid and Plasma Dynamics. In collaboration with members of this research group the successful candidate will set up a vigourous and innovative research programme in mathematical modelling, simulation and analysis of Space Weather. Overlap of research expertise with that already present in the research group "Plasma Astrophysics" is welcome but it is essential that the successful candidate introduces new expertise on Space Weather. Subjects of particular interest are: analysis and interpretation of data, large scale parallel computing, numerical MHD (single fluid, multi-fluid, hybrid codes), kinetic theory, particle acceleration in shocks, solar wind-Earth magnetosphere interaction.

Research at CPA is conducted in collaboration with Belgian, European and American research groups. The candidate must help support and further expand these national and international collaborations. The high level and international quality of the candidate's research should be evidenced by publications in international journals. International research experience is highly appreciated.

The successful candidate is expected to participate in teaching activities in Mathematics at different levels in the university. He/she has to be committed to excellence in teaching. Teaching duties can include service courses outside the mathematics curriculum, courses in the Bachelor and Master of Science programmes of mathematics, courses in the doctoral programme of mathematics, supervision of master and Ph.D. theses. In general, the language of instruction is Dutch, but some activities may be offered in English. Foreign speakers are expected to teach their courses in Dutch after two years.

This position requires a Ph.D. or doctoral degree in Sciences. The appointment will be made at a level consistent with the experience and qualifications of the candidate.

The Faculty of Science is an equal opportunity employer.

22/2020 Modeling and calculation of collective phenomena and complex systems
(starting 1.10.2006)

The Faculty of Science has an opening in the Department of Physics and astronomy for a **full time member of the academic staff, starting October 1st 2006.**

Candidates should be internationally recognised experts with essential new research contributions to mathematical or theoretical physics, combining conceptual penetration with mathematically-technical and computational skills. The candidate is expected to have a broad knowledge of the domain and the growing field of applications of statistical physics, and to be familiar with a range of modern mathematical and computational techniques. They should have demonstrated enduring attention to adapt their research to new developments and interdisciplinary trends like present in computational physics, biophysics or more generally in the modern study of complex dynamical systems in and out of equilibrium.

The candidate should plan to carry out his/her research in collaboration with the members of the theoretical physics unit, and to join and extend the current research programmes.

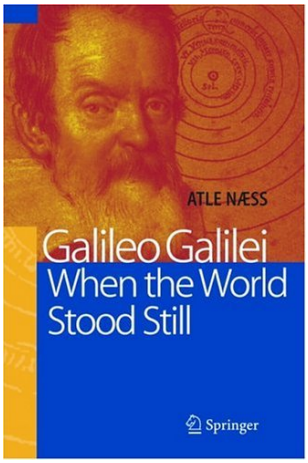
The candidate should be prepared to assume teaching responsibilities in the Physics and Astronomy curricula, as well as in service courses. In a first instance, in the line of statistical thermodynamics, mathematical and numerical methods, and courses in the Master of Science Soft Condensed Matter and in the Master of Science Molecular and Cellular Biophysics. Foreign speakers are expected to teach their courses in Dutch after two years.

The candidate should hold the degree of Doctor in Sciences. Depending on his/her qualifications, the successful candidate will be appointed in one of the appropriate ranks of the academic personnel of the university.

The Faculty of Science is an equal opportunity employer.

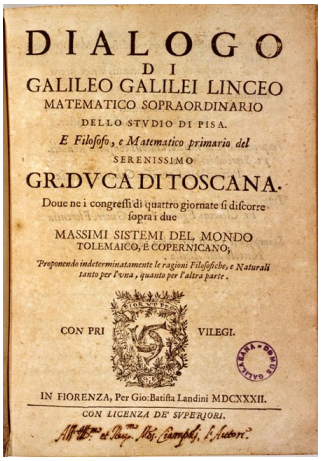
5 Maths and art, fiction, ...

Atle Næss *Galileo Galilei – When the world stood still*, Springer Verlag, Berlin, 2005 (221 p.) ISBN 3-540-21961-7.



It was in January 1633 that Galileo at the age of 69 had to travel to Rome, summoned by the inquisition to appear before the Holy Office without further delay. The result of the trial was that Galileo had to solemnly swear that he 'abjured, cursed, and detested all the errors and heresies' that he had written in his recently published book *Dialogo sopra i due massimi sistemi del mondo* (*Dialogue concerning the two chief world systems*). In that book, he had written down the dialogues of three men –a not unusual format in those days– who discuss during three days their views on the solar system. The characters are a wise man (Sagredo) who invites two scientists (Salviato and Simplicio sic!) to have a scientific meeting in his premisses. Salvatio is defending the Copernican view where the earth is moving and the sun is the center, and Simplicio defends the Aristotelian view where the earth is the center with all planets with the sun circling around it.

Galileo knew that he was skating on thin ice since the Catholic Church did not accept the Copernican system, because of literal interpretion of some phrases in the bible. Formally, Galileo did nothing wrong by letting these fictitious characters discuss the two world systems. So he had somewhat reluctantly received the official Roman imprimatur to have the book published in Florence. However, Galileo made it very clear on which side he was. Simplicio was a simple minded character who was ridiculized by the others, while Salvatio was the witty one. There were several reasons why the book was condemned after all, one of which being the opposing forces of Jesuits and Dominicans, and the political situation at the time. The Jesuits where very eager in bringing Galileo down because of their conservativism and some scientific enemies that Galileo had among them from previous scientific disputes.


DIALOGO
DI
GALILEO GALILEI LINCEO
MATEMATICO SOPRAORDINARIO
DELLO STVDIO DI PISA.
E Filosofo, e Matematico primario del
SERENISSIMO
GR. DVCA DI TOSCANA.
Doue ne i congressi di quattro giornate si discorre sopra i due
MASSIMI SISTEMI DEL MONDO
TOLEMAICO, E COPERNICANO,
Proponendo indeterminatamente le ragioni Filosofiche, e Naturali tanto per l'vna, quanto per l'altra parte.
CON PRI VILEGI.
IN FIORENZA, Per Gio: Batista Landini MDCXXXII.
CON LICENZA DE' SVPERIORI.

title page of the *Dialogo*

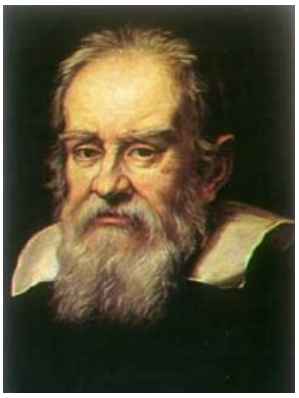
Galileo's tomb in Florence

The Pope in function at the time of the trial was Urban VIII, who was a former admirer of Galileo (as a cardinal he had written several letters to Galileo which he had signed *con fratelo* i.e. like brothers). But he too was in a difficult position and had to choose the side of the jesuits because he needed them like he also needed conservative Spain and France to fight the protestants in Germany.

The condemnation of Galileo was based on a document (actually a Papal decree of February 25, 1616) that researchers long believed to be forged, but recent investigations show that it is probably not. The decree concerned a previous meeting of Galileo with the cardinals Bellarmine and the Jesuit Segizzi where Bellarmine (an admirer of Galileo) had given a moderate warning to Galileo, to be careful and not to come into conflict with Rome. He did that after he had sent Segizzi away who was all too eager to disgrace Galileo. But the decree, which is some kind of minutes of that meeting, says that Galileo

was forbidden to "hold, teach or defend in any way" that the earth was moving. When that almost forgotten document unexpectedly showed up during the trial, that was the end of Galileo's defense.

It is hard to believe that only in the 19th century the vatican partially opened up their archives about Galileo. Even during the Second Vatican Council in the 1960s, the Galileo affair was only alluded to in vague terms. It was the Polish Pope John Paul II Wojtyla (a compatriot of Kepler) who, in 1992 on the occasion of 400th anniversary of Galileo's appointment at the University of Padua, admitted the Church's error. Kepler, being a German protestant, and thus not threatened by the Roman Church, was also defending the Copernican system, but for obvious political and religious reasons, there was little contact with Galileo.



The whole story, of which I made an incomplete summary, is explained in great detail in this pleasantly reading book. All the politics and the delicate interplay between science and theology, between friendship and envy, observation and theory, professional and private duties, and all other subtleties are so marvelously introduced in a way that they keep you reading with eagerness. It is mainly an accumulation of facts, but it reads like a novel where Galileo is the "good guy" that in the end the reader wants to "win and live happily ever after". Unfortunately, that is not the way history goes. It is clearly difficult to reconstruct with certainty the character of Galileo, and there are some controversial opinions about it, expressed by other authors. Everything here is based on objective facts, and reality may only deviate from what is described here by misinterpretation, not by unlimited phantasy of the author. Næss sketches Galileo as an ambitious scientist. Nowadays he would probably be called an engineer. He did many experiments and made many observations, and produced several instruments. He improved the telescope with which he discovered moons of Jupiter, and studied sunspots. He was rather keen on being the first to discover and publish something, and he was not always the most considerate for his admirers. He must have made several scientific enemies in his glory days. Besides his lifelong professorship at the university of Padua, he was the court mathematician the de Medicis who were Grand Dukes of Tuscany, and he became member of the Roman *Accademia dei Lincei* (Academy of the Lynxes – because lynxes have sharp eyes) founded by prince Cesi.

A simple search on the web will reveal many interesting sites devoted to Galileo. There is the site of the Galileo Project at `galileo.rice.edu` giving hypertextual information about Galileo and the science of his time to viewers of all ages and levels of expertise. Much information with transcription of the minutes of the trial can be found at a site about famous trials: `www.law.umkc.edu/faculty/projects/ftrials/galileo/galileo.html`. Besides detailed texts from the trial, there is a lot of other information too like e.g. the text of the decree of 1616, and the text of Galileo's *Dialogues*. About the Galilean moons of Jupiter, you can read at `www2.jpl.nasa.gov/galileo/ganymede/discovery.html`, and there are lots and lots of websites devoted to Galileo and his work as an astronomer, physicist, and mathematician.

Adhemar Bultheel

Some recent (and one not so recent) book(s) about numbers

Reading the review by Jean Mawhin of the book *Mathematical Constants* by S.R. Finch in the Bulletin (vol.12 nr.3), it seemed fitting to review some books that are wholly devoted to one mathematical constant. Over the last few years a number of those have been published. I'll take them in numerical order.

Zero: The Biography of a Dangerous Idea, Charles Seife, Penguin Books, 2000, 256 p., ISBN: 0140296476.

This book is much more than the history of the number zero, as you can see from the titles of some of the chapters: The Theology of Zero, The Physics of Zeros, Make your own wormhole time machine (Appendix E). The book is very well written, and I recommend it as a pastime. Not much mathematics in it, and the book is not without errors.

The Nothing That Is: A Natural History of Zero, Robert Kaplan, Oxford University Press, 2000, 240 p., ISBN: 0195142373.

Another history of that same number, but this one more difficult to read due to the author's peculiar style. Even less formulas here, but you need to know more about mathematics to be able to follow the author's arguments than for Seife's book.

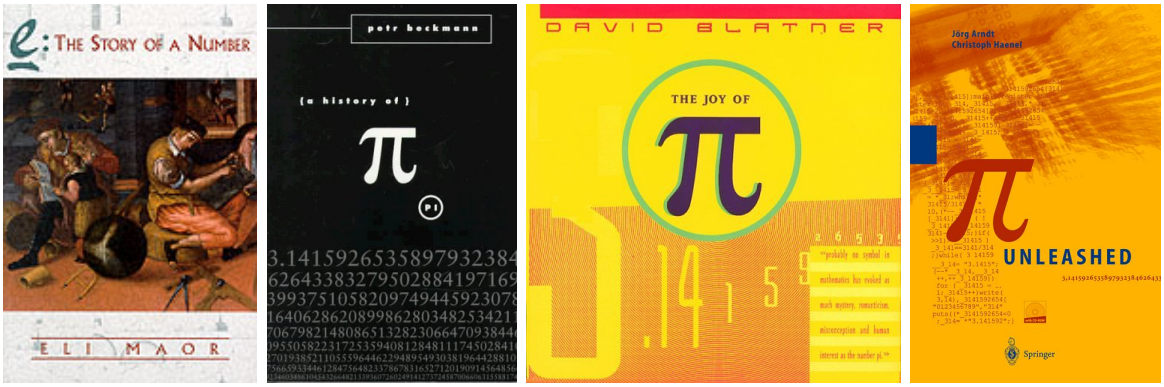
Gamma : Exploring Euler's Constant, Julian Havil, Princeton University Press, 2003, 376 p., ISBN: 0691099839.

This book is about the Euler-Mascheroni constant 0.577 215 664..., one of the less-known mathematical constants. A very mathematical book, not at all in the same league as the previous two. It takes a serious effort to read it, but I think it's worth it. It starts off with logarithmic tables and ends with the Riemann Hypothesis, and ... it contains the essence of complex function theory as an appendix. Highly recommended. I learned a lot reading this book.

The Golden Ratio : The Story of PHI, the World's Most Astonishing Number, Mario Livio, Broadway, 2003, 304 p., ISBN: 0767908163.

The number Phi, the golden ratio, seems to crop up everywhere, in nature, in art, in music. 'Seems' is the right word in this case, as author Mario Livio tries to show in this book. He talks about the history of the number, but spends too much time trying to

debunk theories like the one that claims that the architecture behind the pyramids of Egypt is full of the number Phi. The book contains a lot of information, it is an easy read, but I did not particularly like it.



e: The Story of a Number, Eli Maor, Princeton University Press, 1998, 232 p., ISBN: 0691058547.
(The mathematical counterweight to the novel La Disparition by the French author Georges Perec 🙂

It seems strange that one had to wait this long for a book about the number e. Eli Maor relates its history from Napier to complex analysis, stopping on the way for a historic conversation between J.S. Bach and Johann Bernoulli about the equal-tempered scale. It has been some time since I've read the book, but I remember that I liked it. Maor knows how to tell a story.

A History of Pi, Petr Beckmann, St. Martin's Griffin, 1976, 208 p., ISBN: 0312381859.

This book, although old, is still in print. It contains an interesting mix of history and mathematics, keeping it alltogether light. But in it you'll find Brouncker's continued fraction for π, and Euler's derivation of the sum of the series for $\zeta(2n)$, and Euler's generalisations of Machin's formula. There is also a chapter on the digit hunters. Much has happened with π during the last 30 years, but this book is still worth reading.

The Joy of Pi, David Blatner, Penguin Books, 1998, 130 p., ISBN: 0140266801.

The layout of this book is something else, but it is a pity not much more can be said about it. A short history of π, something about the Chudnovsky brothers, about the nature of π, a chapter on the circle squarers, and some mnemonics for π, that's all there is.

Pi - Unleashed, Jorg Arndt, Christoph Haenel, Springer, Bk&CD Rom edition, 2001, 270 p., ISBN: 3540665722.

A very interesting book, contains everything you ever need to know about the number π, its history and calculation. I especially like the chapter entitled π Formula Collection: a very large collection of series, products, continued fractions and algorithms for the calculation of π. The book comes with a CD Rom with a lot of programs for π, with the 400 million first decimals of π, and with a number of links to π-sites. Highly recommended. But things about π change quickly, and not all the material in this book is still up to

date: the world record in the recitation of π, for instance, is no longer 42 000 digits (p.47), but since the the first of July it is 83 431 digits (held by Akira Haraguchi of Japan).
Other books about π that I haven't read (yet):
Le fascinant nombre pi, Jean-Paul Delahaye, Éditions Belin/Pour La Science, 1997, 224 p., ISBN: 2902918259 (translated in Dutch in 2004).
The Number Pi, Pierre Eymard, Jean-Pierre Lafon, Stephen S. Wilson (Translator), American Mathematical Society, 2004, 322 p., ISBN: 0821832468 (translation of **Autour du nombre Pi**, Hermann, 1999, 318 p., ISBN: 2705614435).
Pi: A Biography of the World's Most Mysterious Number Alfred S Posamentier, Ingmar Lehmann, Prometheus Books, 2004, 324 p., ISBN: 1591022002.

An Imaginary Tale, Paul J. Nahin, Princeton University Press, 1998, 274 p., ISBN: 0691027951.

Now, making a right angle turn to the left, we come to the complex number $\sqrt{-1}$. This is a book I would have liked to have written myself. It is not an easy book, there's lots of mathematics in it, but (nearly) everything is explained very clearly. The major part is about the history of i, but you will also find some applications of complex numbers discussed. This book too ends with an introduction to complex integration.
All these books have found a prominent place on my bookshelf, as you can see in the picture above.

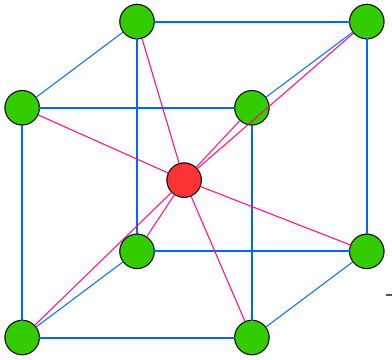
Paul Levrie

Orbits on vertices and edges in finite regular graphs

Nicolas BOUGARD, ULB

A well known Belgian graph

and its orbits



$\longrightarrow$ *realizes* $(\nu, \epsilon) = (2, 2)$

Automorphism = permutation of the vertices mapping *edge* on *edge*

non edge on *non edge*

$\longrightarrow$ $Aut(G)$

Orbits $\longrightarrow$ on vertices — $\nu = \sharp$ vertex-orbits

$\longrightarrow$ on edges — $\epsilon = \sharp$ edge-orbits

Theorem 1 (Buset, 1985)
(ν, ϵ) realizable by a graph iff $\nu \leq 2\epsilon + 1$
(ν, ϵ) realizable by a connected graph iff $\nu \leq \epsilon + 1$

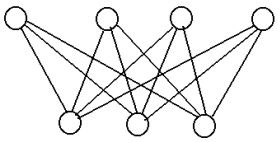
Theorem 2 (Submitted to Journal of Graph Theory)
If $k \geq 3$, then (ν, ϵ) realizable by a connected $k-$regular graph iff $\nu - 1 \leq \epsilon \leq (k-1)\nu + 1$

Theorem 3 (To appear in European Journal of Combinatorics)
If $k \geq 3$, then (ν, ϵ) realizable by a $k-$regular graph iff $\nu \leq 2\epsilon \leq 2k\nu$

Graphs realizing $(2, 1)$

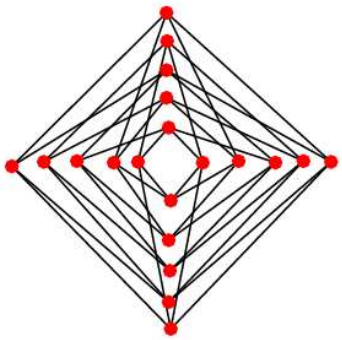
Non regular graphs: $K_{a,b}$ $(a \neq b)$

$K_{3,4}$

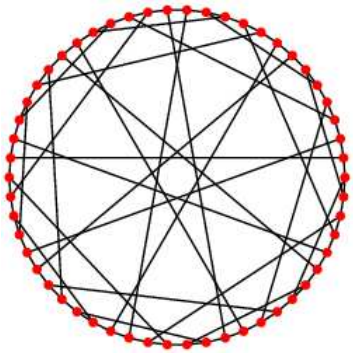


Regular graphs:

Folkman Graph



Gray Graph



Theorem 4 (To appear in European Journal of Combinatorics)
Countably many $k-$regular graphs realize $(2, 1)$ for every $k \geq 3$