

**NEDERLANDS MATHEMATISCH  
CONGRES 2010**

**onder auspiciën van het Koninklijk Wiskundig Genootschap**

**22 en 23 april 2010, Utrecht**

## **Congrescommissie**

Frits Beukers  
Roelof Bruggeman  
Michiel Doorman  
Sasha Gnedin  
Sebastiaan Janssens  
Joop Kolk  
Ambi Oosterhout  
Wilbert Ouburg  
Dirk Siersma (voorzitter)

## **Colofon**

Ontwerp kaft: Michiel Doorman  
Samenstelling: Sasha Gnedin  
Drukwerk:

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# 1 Voorwoord

Van harte welkom op het Nederlands Mathematisch Congres 2010!

Het is de 46<sup>e</sup> keer dat het NMC wordt gehouden. De plaats van ontmoeting wisselt met regelmaat door heel Nederland en soms daarbuiten; dit is het vierde congres dat plaats heeft in Utrecht.

De congrescommissie heeft getracht een programma op te stellen dat interessant is voor alle wiskundigen, of ze nu op de universiteit werken, in bedrijf of industrie, op school, in opleiding zijn of al gepensioneerd.

De masterstudenten krijgen dit jaar speciale aandacht. Met hen is bij de keuze van het programma nadrukkelijk rekening gehouden. Bovendien vindt met steun van Mastermath een Mastermath-lunch plaats op vrijdag, de tweede congresdag. Kortom, een ontmoetingspunt voor alle masterstudenten in Nederland. Naar wij hopen zal deze lunch een traditie worden.

Naast drie plenaire voordrachten en zes parallelvoordrachten zijn er tien minisymposia, de tweejaarlijkse Beegerlezing op het gebied van getaltheorie, en op donderdag in samenwerking met het Studium Generale van de Universiteit Utrecht, een publieke avondvoordracht *Mathematics, Magic and the Electric Guitar* door David Acheson.

Voor leraren is het programma op de vrijdag extra interessant. Het onderdeel Leraar en Wiskunde ademt de sfeer van de Nationale Wiskundedagen.

De congresorganisatie is in handen van leden van het departement Wiskunde van de UU, dat bestaat uit het Mathematisch Instituut en het Freudenthal Instituut, tezamen met een aantal van onze wiskundestudenten. In het bijzonder treft u studenten aan bij de welkomstbalie en als zaalassistent bij de voordrachten.

De illustraties op de poster en het programmaboekje zijn naar een ontwerp van collega Henk van der Vorst.

Wij wensen U een heel mooi en onderhoudend congres toe!

Namens de congrescommissie,

Dirk Siersma, voorzitter

## **Sponsors**

Dit congres is mede mogelijk gemaakt door de financiële ondersteuning van:

- Centrum voor Wiskunde en Informatica
- Koninklijk Wiskundig Genootschap
- Mastermath
- NWO-cluster DIAMANT
- NWO-cluster GQT
- NWO-cluster NDNS+
- Onderzoekschool MRI
- Onderzoekschool Stieltjes
- Philips Research
- Studium Generale UU
- Universiteit Utrecht

## 2 Algemene informatie

De organisatiecommissie van het congres is voor de aanvang van het congres bereikbaar via tel. +31(0)30 253 37 49, email [R.W.Bruggeman@uu.nl](mailto:R.W.Bruggeman@uu.nl)

De congresbalie bevindt zich in de foyer van het Educatorium. De congresbalie is op beide dagen vanaf 9:00 uur geopend. Bij de balie kunt u terecht voor de ontvangst van de congresbescheiden, badge, etc. Ook mededelingen over het programma en eventuele berichten voor deelnemers aan het congres treft u aan bij de balie.

### **Locatie en bereikbaarheid**

Het congres vindt plaats in het Educatorium in De Uithof, een gebouw van de Universiteit Utrecht met als adres: Leuvenlaan 19, 3584 CE Utrecht. Buslijnen 11 en 12 verbinden het Centraal Station Utrecht met De Uithof; de halte Heidelberglaan is vlak bij het Educatorium. Er zijn betaalde en onbetaalde parkeerplaatsen in de Uithof, vaak met weinig beschikbare plaatsen.

### **Plaats van de voordrachten**

De plenaire voordrachten vinden plaats in de Megaronzaal op de eerste verdieping van het Educatorium.

De overige voordrachten vinden plaats in de Megaronzaal en verder in de de Blauwe Zaal, de Rode Zaal en Zaal A op de begane grond van het aangrenzende Marinus Rupertgebouw. De avondvoordracht op donderdag is in het Academiegebouw, Domplein 29, in de binnenstad. Om dit gebouw te bereiken kan men bus 11 nemen vanuit De Uithof naar de binnenstad; uitstappen halte Janskerkhof; daarna de Korte Jansstraat en de Domstraat doorlopen naar het Domplein. Ga tussen de Domtoren en de Domkerk door. Het Academiegebouw, Domplein 29, is links in de hoek van het plein.

### **Koffie/thee en lunches**

Koffie en thee zijn op vertoon van de congresbadge gratis verkrijgbaar in de foyer van het Educatorium. Tijden: donderdag vanaf 09:00 uur tot 09:45 uur, en van 15:30 tot 16:00 uur. Op vrijdag van 10:15 tot 10:45 uur en van 15:40 tot 16:05 uur.

De lunches worden gehouden in de foyer van het Educatorium; de tijden zijn op donderdag van 12:00 tot 13:30 uur en op vrijdag van 12:45 tot 13:45 uur.

### **Borrel**

Op donderdag 22 april is in de foyer van het Educatorium van 16.45 tot 18.00 uur een borrel.

### **Ledenvergadering van KWG**

Tijdens het congres vindt de ledenvergadering van het Koninklijk Wiskundig Genootschap plaats, op donderdag 22 april 12:30 – 13:25 uur in zaal Megaron.

## 3 Programma

### 3.1 Overzicht donderdag 22 april

9:00–9:45	inschrijving en koffie
9:45–10:45 Megaron	opening door prof.dr. Alfred Blik, decaan van de faculteit Bètawetenschappen plenaire voordracht: <b>Günter Ziegler, Berlin</b> <i>Colored versions of Tverberg's theorem</i>
10:45–11:15	pauze
11:15–12:00	semiplenaire voordrachten (parallel):
Blauwe Zaal	<b>Geurt Jongbloed, Delft</b> <i>Testing local monotonicity of a hazard rate</i>
Rode Zaal	<b>Duco van Straten, Mainz</b> <i>Calabi–Yau periods</i>
Megaron	<b>Jan Bouwe van den Berg, VU</b> <i>Braids and chaos</i>
12:00–13:30	lunch
12:30–13:25 Megaron	ledenvergadering KWG
13:30–15:30	minisymposia (parallel):
Blauwe Zaal	<i>Analyse en dynamische systemen</i>
Megaron	<i>Meetkunde en topologie</i>
Rode Zaal	<i>Stochastiek</i>
15:30–16:00	pauze
16:00–16:45 Megaron	plenaire voordracht: <b>Renate Loll, Utrecht</b> <i>Probing the Planckian structure of spacetime</i>
16:45–18:00	borrel
20:00–20:30 20:30–21:30	koffie
Academiegeb.	lezing Studium Generale: <b>David Acheson, Oxford</b> (in samenwerking met Studium Generale UU) <i>Mathematics, Magic and the Electric Guitar</i>

### 3.2 Overzicht vrijdag 23 april

9:30–10:15	semiplenaire voordrachten (parallel):
Blauwe Zaal	<b>Rainer Kaenders, Keulen</b> <i>Mathematical awareness</i> (lezing in het Nederlands)
Megaron	<b>Florian Luca, Morelia</b> <i><math>\varphi</math> and <math>\sigma</math>, from Euler to Erdős</i> (Beeger lecture)
Rode Zaal	<b>Rob de Boer, Utrecht</b> <i>Modeling the immune system</i>
10:15–10:45	pauze
10:45–12:45	minisymposia (parallel):
Blauwe Zaal	<b>Biowiskunde</b>
Megaron	<b><i>Geschiedenis van de wiskunde</i></b> (in het Nederlands)
Rode Zaal	<b><i>Impact van nieuwe ICT mogelijkheden</i></b>
Zaal A	<b><i>Voordrachten Philipsprijs</i></b>
12:45–13:45	lunch (Mastermath-lunch op het pi-balkon)
13:45–15:45	minisymposia (parallel):
Blauwe Zaal	<b>Getaltheorie</b>
Megaron	<b><i>Leraar en wiskunde</i></b> (in het Nederlands)
Rode Zaal	<b><i>Scientific computing</i></b>
13:45–14:45	De boekerij van het KWG:
Zaal A	<b>Astrid Balsem, UvA</b> <i>Het erfgoed van het KWG</i> (lezing in het Nederlands)
14:25–15:45	Minisymposium <b><i>Freudenthal's Selecta</i></b>
Zaal A	
15:45–16:05	pauze
16:05–16:50	slotvoordracht:
Megaron	<b>David Bressoud, St. Paul</b> <i>Historical Reflections on Teaching Calculus/Analysis</i>
16:50–17:00	prijzuitreiking Philipsprijs, sluiting
Megaron	

## 4 Toelichting op bepaalde programma-onderdelen

### 4.1 Philips Wiskundeprijs voor promovendi

Er zal dit jaar voor de vijfde maal de Philips Wiskundeprijs voor promovendi worden toegekend. De toekenningen uit de voorafgaande jaren zijn:

2006 Joost Batenburg (UL) met de voordracht “Steps toward 3D atomic resolution microscopy using discrete tomography”, tijdens het NMC in Delft,

2007 Johan Bosman (UL) met de voordracht over “Computations in Inverse Galois Theory”, tijdens het NMC in Leiden,

2008 Erik Jan van Leeuwen (CWI) met zijn voordracht “Geometric optimization for wireless networks and computational biology”, tijdens het 5ECM in Amsterdam,

2009 Stefan van Zwam (TUE) met zijn voordracht “How to show it does not fit”, tijdens het NMC in Groningen.

Tijdens een speciaal mini-symposium op

donderdag 22 april 2010 tussen 10:45 en 12:45 uur in Zaal A

krijgen de promovendi gelegenheid over hun werk te vertellen. Uit de verschillende voordrachten zal een deskundige jury de beste selecteren. De jury voor de Philips Wiskundeprijs voor promovendi 2010 bestaat uit:

prof.dr. Ferdinand Verhulst (voorzitter, UU)

prof.dr. Richard Gill (UL)

prof.dr. Jan van Mill (VU)

De voordrachten zijn gericht op een algemeen wiskundig publiek. Een belangrijk criterium voor de toekenning van de prijs is dan ook dat de voordracht van maximaal 20 minuten voor niet-specialisten begrijpelijk moet zijn. De kandidaten zijn promovendi op het gebied van de wiskunde aan een Nederlandse instelling en op 22 april 2010 nog niet gepromoveerd.

De prijs, bestaande uit een geldbedrag en een wisseltrofee, zal voorafgand aan de sluiting van het congres (vrijdag 23 april, 16:50–16:55 uur in zaal Megaron) aan de winnende promovendus of promovenda worden overhandigd.

## 4.2 Jaarvergadering Koninklijk Wiskundig Genootschap

Het NMC2010 vindt plaats onder auspiciën van het Koninklijk Wiskundig Genootschap (KWG). Het KWG is een landelijke vereniging van beoefenaars van de wiskunde en iedereen die de wiskunde een warm hart toedraagt. De vereniging is in 1778 opgericht en is 's werelds oudste nationale wiskundegenootschap. Het genootschap heeft als doel de wiskunde te bevorderen en haar beoefening en toepassingen aan te moedigen. Daarnaast vertegenwoordigt het KWG de Nederlandse wiskundige gemeenschap in binnen- en buitenland.

Volgens de traditie is het NMC de gelegenheid waar veel leden van het KWG elkaar ontmoeten, terwijl de jaarlijkse ledenvergadering van het KWG altijd tijdens dit congres wordt gehouden. Tijdens het NMC2010 staat de 233ste Algemene Ledenvergadering gepland op

donderdag 22 april, tussen 12:30 en 13:25 uur in zaal Megaron.

De vergaderstukken zijn opgenomen in het

Nieuwe Archief voor Wiskunde (5) **11**, Nr. 1, maart 2010.

## 4.3 Beegerlezing

Dr. N.G.W.H. Beeger was a Dutch mathematician, born in Utrecht in 1884, who died in Amsterdam in 1965. He wrote a doctor's thesis on Dirichlet series (1916). Until his 65th year, he worked as a high school teacher, but in the evening hours he managed to produce about thirty papers and many reviews on elementary and algebraic number theory. One of his last publications was a table of prime numbers in the eleventh million. After his retirement as a teacher he started an extensive correspondence with other mathematicians like Gloden, Golubev, Ferrier, Bianchini and Lehmer. Beeger had good contacts with the former Mathematical Centre in Amsterdam (now called Centrum Wiskunde en Informatica, CWI) and he bequeathed part of his inheritance to this institute. In 1989, the Board of Trustees of CWI established a biennial *Beeger Lecture*, to be funded by the returns of the Beeger legacy. Its purpose is to promote research and exchange of ideas in the field of Algorithmic and Computational Number Theory. As a rule, the Beeger Lecture is delivered during the yearly Congress of the Royal Dutch Mathematical Society. Until now, nine Beeger Lectures have been presented, namely, by Carl Pomerance (NMC1992, Delft), Hugh Williams (NMC1994, Leiden), John Conway (1996, AMS BeNeLux Congress, Antwerpen), Hendrik Lenstra (NMC1998, Enschede), Peter Borwein (2000, ANTS IV, Leiden), Bjorn Poonen (NMC2002, Eindhoven), Manjul Bhargava (NMC2004, Tilburg), Manindra Agrawal (NMC2006, Delft), and Dan Bernstein (NMC2008 and 5ECM, Amsterdam). An Advisory Committee for the Beeger Lecture consisting of Prof. J.K. Lenstra (Director of CWI), Prof. F. Beukers (Utrecht), Prof. H.W. Lenstra (Leiden), Prof. R. Tijdeman (Leiden), and Dr. H.J.J. te Riele (CWI, secretary of the

Committee), has proposed Prof. Florian Luca from the Instituto de Matemáticas de la Universidad Nacional Autónoma de México as the 2010 Beeger Lecturer.

The Beeger Lecturer Florian Luca (born 1969 in Romania) is full professor at the Instituto de Matemáticas UNAM, Morelia, México. His research interests are abstract algebra, algebraic number theory, and Diophantine equations. He has been visiting professor at Dartmouth College, UAM Madrid, Williams College, Czech Academy of Sciences, University of Bielefeld, and Syracuse University. Over the period 1997–2010 his CV contains a list of 345 papers in number theory in refereed journals, and more than 150 conference talks. He has many joint papers with mathematicians originating from developing countries. He obtained a Young researcher award from UNAM in 2008, a Guggenheim Fellowship in 2006, and an Alexander von Humboldt Fellowship in 1998–1999.

#### **4.4 Voordracht in het kader van het Studium Generale van de UU**

Op donderdagavond 22 april is er in samenwerking met het Studium Generale van de Universiteit Utrecht een wiskundige voordracht gericht op een breed publiek:

Mathematics, Magic and the Electric Guitar  
spreker / performer: David Acheson.

Deze vindt plaats van

20:30 tot 21:30 uur in het Academiegebouw, Domplein 29,

in de binnenstad van Utrecht. Om dit gebouw te bereiken kan men bus 11 nemen vanuit De Uithof naar de binnenstad; uitstappen halte Janskerkhof; daarna de Korte Jansstraat en de Domstraat doorlopen naar het Domplein. Ga tussen de Domtoren en de Domkerk door. Het Academiegebouw, Domplein 29, is links in de hoek van het plein.

De zaal is open vanaf 20:00 uur; vanaf die tijd wordt koffie geserveerd.

#### **4.5 De boekerij van het KWG**

Het KWG heeft een waardevolle collectie van boeken en tijdschriften in bruik bij de Universiteitsbibliotheek van UvA. De lezing van Astrid Balsem op vrijdagmiddag besteedt aandacht aan deze collectie.

## 5 Zalenrooster minisymposia

### 5.1 Donderdag 22 april 13:30–15:30

Tijd	Spreker	Plaats
<b>Analyse en dynamische systemen</b>		
13:30–14:05	<b>Marcel de Jeu, Leiden</b> <i>Real Paley-Wiener theorems and local spectral radius formulas</i>	Blauwe Zaal
14:10–14:45	<b>Ale Jan Homburg, UvA</b> <i>Forced circle diffeomorphisms</i>	Blauwe Zaal
14:50–15:25	<b>Holger Waalkens, Groningen</b> <i>A periodic orbit formula for quantum reactions through transition states</i>	Blauwe Zaal
<b>Meetkunde en topologie</b>		
13:30–14:05	<b>Frans Clauwens, Nijmegen</b> <i>Cohomology of dihedral quandles</i>	Megaron
14:10–14:45	<b>Walter van Suijlekom, Nijmegen</b> <i>Noncommutative geometry and some of its applications</i>	Megaron
14:50–15:25	<b>Dieter Notbohm, VU</b> <i>Almost complex structures for quasi-toric manifolds</i>	Megaron
<b>Stochastiek</b>		
13:30–14:05	<b>Roberto Fernandez, Utrecht</b> <i>Non-Markovian chains</i>	Rode Zaal
14:10–14:45	<b>Michel Mandjes, UvA</b> <i>Simulation-based computation of the workload correlation function in a Lévy-driven queue</i>	Rode Zaal
14:50–15:25	<b>Harry van Zanten, Eindhoven</b> <i>Asymptotic results for nonparametric Bayes procedures</i>	Rode Zaal

## 5.2 Vrijdag 23 april 10:45–12:45

Tijd	Spreker	Plaats
<b>Biowiskunde</b>		
10:45–11:20	<b>Mathisca de Gunst, VU</b> <i>Mathematics meets neuroscience</i>	Blauwe Zaal
11:25–12:00	<b>Ernst Wit, Groningen</b> <i>Looking for sparse genetic needles in high-dimensional haystacks</i>	Blauwe Zaal
12:05–12:40	<b>Sander Hille, Leiden</b> <i>Reverse engineering of the auxin transport process in Arabidopsis plants</i>	Blauwe Zaal
<b>Geschiedenis van de wiskunde</b>		
Thema: <i>Verspreiding van wiskundekennis rond 1600</i> (lezingen in het Nederlands)		
10:45–11:20	<b>Ad Meskens, Antwerpen</b> <i>Leve de Republiek! De Antwerpse rekenmeesters ten tijde van de godsdienstoorlogen</i>	Megaron
11:25–12:00	<b>Steven Wepster, Utrecht</b> <i>Kennistransformatie in de vroege Republiek / Knowledge transformation in the early Dutch Republic</i>	Megaron
12:05–12:40	<b>Djoeke van Netten, UvA</b> <i>Drukkers en uitgevers en de verspreiding van wiskunde in de zeventiende eeuw</i>	Megaron
<b>Impact nieuwe ICT-mogelijkheden</b>		
10:45–11:20	<b>Marc van Leeuwen, Poitiers</b> <i>The Atlas of Lie Groups and Representations project and software</i>	Rode Zaal
11:25–12:00	<b>Henk Dijkstra, Utrecht</b> <i>High resolution simulation of the global ocean circulation</i>	Rode Zaal
12:05–12:40	<b>Gunnar W. Klau, CWI</b> <i>Prize-collecting Steiner trees in protein interaction networks</i>	Rode Zaal
<b>Voordrachten Philipsprijs</b>		
10:45–12:45		Zaal A

### 5.3 Vrijdag 23 april 13:45 – 15:45

Tijd	Spreker	Plaats
<b>Getaltheorie</b>		
13:45–14:35	<b>Matthias Flach, Caltech</b> <i>Weil-étale cohomology of regular arithmetic schemes</i>	Blauwe Zaal
14:45–15:35	<b>Matthias Schütt, Hannover</b> <i>Arithmetic of K3 surfaces</i>	Blauwe Zaal
<b>Leraar en wiskunde</b> (lezingen in het Nederlands)		
13:45–14:20	<b>Klaas Landsman, Nijmegen</b> <i>Bestaat toeval (anno 2010)?</i>	Megaron
14:25–15:00	<b>Bob Planqué, VU</b> <i>Het wiskundige brein van de mier</i>	Megaron
15:05–15:40	<b>Anja Volk, UU</b> <i>Mathematics and the groove in music</i>	Megaron
<b>Scientific computing</b>		
13:45–14:20	<b>Joost Rommes, NXP Semiconductors</b> <i>Graph algorithms in the electronics industry</i>	Rode Zaal
14:25–15:00	<b>Kees Oosterlee, Delft &amp; CWI</b> <i>On an efficient method for pricing financial options on the graphics processing unit</i>	Rode Zaal
15:05–15:40	<b>Michiel Hochstenbach, Eindhoven</b> <i>Linear discrete ill-posed problems and image deblurring</i>	Rode Zaal
<b>Freudenthal's Selecta</b>		
14:25–15:00	<b>Dirk van Dalen, Utrecht</b> <i>Hans Freudenthal - universalist and specialist</i>	Zaal A
15:05–15:40	<b>Tonny A. Springer, Utrecht</b> <i>Freudenthal and Lie theory</i>	Zaal A



## 6 Samenvattingen plenaire voordrachten

### Colored versions of Tverberg's theorem

Günter M. Ziegler (Berlin)

April 22, 09:50–10:45, Megaron

**Abstract:** In the winter 1964, the young Norwegian mathematician Helge Tverberg was sitting in a hotel room in Manchester, freezing, and proved a  $d$ -dimensional version of the following result by Bryan Birch (1958): Given  $3r - 2$  points in the plane, one can always divide them into  $r$  groups of at most three points, whose convex hulls intersect. One point less is not enough. For the  $d$ -dimensional version of this result, the minimal number of points is  $(d + 1)(r - 1) + 1$ , according to “Tverberg’s theorem”, published 1966.

In 1989, Bárány, Füredi, and Lovász found that they needed a “colored version” of Tverberg’s theorem. Such a result was achieved by Vrecica and Zivaljevic (1992). Their proof introduced elegant topological results, as well as fascinating combinatorial structures (“chessboard complexes”), but the result was not sharp – they required more than the conjectured number of points.

Now we can present a surprising new, sharp “colored” version of the original Tverberg theorems, and new tools are used for the proofs. So there is progress to report about... (Joint work with Pavle V. Blagojevic and Benjamin Matschke.)

### Probing the Planckian Structure of Spacetime

Renate Loll (Utrecht)

April 22, 16:00 – 16:45, Megaron

**Abstract:** Already Riemann contemplated the need for modifying our conventional notions of the metric properties of space on scales which are “immeasurably small”, a need that should be driven empirically by new insights gained in physics. Great strides have been made since in understanding the theoretical foundations of the physical world, in the form of special and general relativity, quantum theory and quantum field theory. Taken together they strongly suggest the existence of a theory of quantum gravity, which should provide a consistent and quantitative description of the nature of “quantum spacetime” on ultrashort, Planckian length scales. After decades of research, the problem of finding this theory is still outstanding.

I will report on recent, unprecedented progress in a new formulation of quantum gravity, called Causal Dynamical Triangulation. It is based on performing a “sum over histories” by using an intrinsically geometric way of regularizing this quantum superposition in terms of triangulated, piecewise flat spacetimes. In two dimensions, evaluating

the sum takes the form of a combinatorial problem, which can be solved explicitly. In the physically relevant case of four spacetime dimensions, nontrivial properties of the sum over spacetimes can be extracted with the help of numerical simulations, yielding some intriguing results which confirm the highly nonclassical nature of spacetime geometry at the Planck scale, and the emergence from it of classical geometry on large scales.

### **Mathematics, Magic and the Electric Guitar**

David Acheson (Oxford)

April 22, avond, Academiegebouw

**Abstract:** Why are so many people frightened of mathematics? Even at its simplest level, the subject is full of surprises that anyone can enjoy. I will start with a simple number trick that always gives the answer 1089 and then move on to surprises in geometry, chaos theory and electric guitar dynamics. I will even examine if mathematics can explain the magical Indian Rope Trick. Most importantly of all, however, I will suggest ways in which anyone can see how mathematics has a certain magic of its own.

### **Historical Reflections on Teaching Calculus/Analysis**

David Bressoud (St. Paul)

April 23, 16:05–16:50, Megaron

**Abstract:** The history of mathematics can and should play three important roles in support of the teaching of mathematics: It helps students to understand the process of discovering mathematical truths, it explains the motivation behind the creation of definitions and assumptions and thus enriches their meaning, and it informs pedagogy by displaying the historical difficulties even the best mathematicians of their era encountered. This talk will illustrate all three of these roles as they inform the teaching of calculus/analysis, with emphasis on the conceptual difficulties encountered in the 19th century and how they are reflected in the work of Cauchy, Riemann, and Borel.

## 7 Samenvattingen semiplenaire voordrachten

### Testing local monotonicity of a hazard rate

Geurt Jongbloed (TU Delft)

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April 22, 11:15–12:00, Rode Zaal

**Abstract:** The hazard rate of a distribution is a function that makes precise the idea of ageing of products or people. A hazard rate that is increasing reflects deterioration in time, whereas a decreasing hazard rate means that a product actually gets more reliable having survived longer. In this talk, I will introduce the problem of testing for local monotonicity of a hazard rate. Various test statistics and approximations to their null distributions have appeared in the literature. These approaches will be discussed and compared to a new procedure, introduced in joint work with Piet Groeneboom.

### Calabi-Yau periods

Duco van Straten (Mainz)

April 22, 11:15–12:00, Rode Zaal

**Abstract:** The remarkable properties of periods of families of elliptic curves are well-known. The talk will be about extensions of these properties to families of Calabi-Yau varieties.

### Braids and chaos

Jan Bouwe van den Berg (VU)

April 22, 11:15–12:00, Megaron

**Abstract:**

Pieces of string or curves in three dimensional space may be knotted or braided. This physical idea can be used as a topological tool to study certain types of dynamical systems. In particular, such an approach leads to forcing theorems in the spirit of the famous “period three implies chaos” for interval maps. We discuss an application to a differential equation from the field of pattern formation. This involves several illuminating topological arguments, which are complemented by an illustrative computer-assisted approach.

### **Mathematical Awareness**

Rainer Kaenders (Universität zu Köln)

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April 23, 9:30–10:15, Blauwe

**Abstract:** What does it mean to have learned mathematics? It certainly involves knowledge and proficiencies. But how can we make the objectives of mathematics teaching precise? The usual way (like in most national curricula, or assessments like PISA or TIMSS) is to demand certain competences. However, competences can more and more be taken over by new media like computer algebra etc. As a consequence aiming for such competences often modifies traditional mathematics courses into a superficial treatment of machines. *Mathematical awareness* is an attempt of Ladislav Kvasz en myself to formulate objectives of mathematics teaching which allows to distinguish different qualities of insight and knowledge – and in particular deep from superficial ones. It follows from this approach that the role of new media is recognized but does not put long-established mathematics teaching in jeopardy. As illustration, we will broaden the usual awareness for the solution of polynomial equations by the surprising method of Lill.

### **$\phi$ and $\sigma$ , from Euler to Erdős**

Florian Luca (Instituto de Matemáticas de la Universidad Nacional Autónoma de México)

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April 23, 9:30–10:15, Megaron

**Abstract:** In the first part of this talk, we will survey various old and new results related to the distribution of the values of the Euler function  $\phi(n)$  and the sum of divisors function  $\sigma(n)$  of a positive integer  $n$ , their popular values, their champions, as well as to the distribution of those positive integers satisfying certain equations involving such functions, like the perfect numbers and the amicable numbers. In the second part of the talk, we will give some of the ideas involved in a proof of a recent result obtained jointly with Kevin Ford and Carl Pomerance which says that there are infinitely common values in the ranges of these two functions. This settles a 50 year old question of Paul Erdős.

### **Modeling the Immune System**

Rob J. de Boer (Utrecht University)

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April 23, 9:30–10:15, Rode Zaal

**Abstract:** The immune system is a fascinating complex system taking decisions on how to respond to a wide variety of stimuli, varying from lethal pathogens to harmless

proteins in the food. Decisions are remembered for life in the form of immunological memory. By mathematical modeling, computer simulation, and bioinformatics we aim to better understand how this complex system is functioning. This requires a quantitative approach of estimating various population sizes, the turnover rates of the cells within each population, their migration rates, and the rates at which cells form contacts with other cells. Development of the proper formal models for this can be challenging.



## 8 Samenvattingen voordrachten minisymposia

### 8.1 Analyse en dynamische systemen

#### Real Paley-Wiener theorems and local spectral radius formulas

Marcel de Jeu (Leiden)

April 22, 13:30–14:05, Blauwe Zaal

**Abstract:** The classical complex Paley-Wiener theorems relate the support of a function on  $\mathbb{R}^n$  to the growth rate of its Fourier transform on  $\mathbb{C}^n$ . In the first part of the lecture, we will show how the support can also be related to certain growth rates of the Fourier transform on  $\mathbb{R}^n$  (as opposed to  $\mathbb{C}^n$ , and why these so-called real Paley-Wiener theorems are more precise than the complex ones can be. In the second part, we will explain how some of these real Paley-Wiener theorems are manifestations of local spectral radius formulas. This is joint work with Nils Andersen.

#### Forced circle diffeomorphisms

Ale Jan Homburg (University of Amsterdam)

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April 22, 14:10–14:45, Blauwe Zaal

**Abstract:** Synchronization of dynamics can occur not only as a result of coupling, but also by external forcing. I will discuss synchronization in dynamics of circle diffeomorphisms that are forced by a simple chaotic dynamical system; an expanding circle map. One may think of examples like  $(y, x) \mapsto (3y, x + \frac{1}{8} \sin(2\pi x) + y) \bmod 1$ , where a standard circle diffeomorphism is forced by  $y \mapsto 3y \bmod 1$ . The resulting synchronization occurs robustly, i.e. is persistent under perturbations of the dynamics. Its study uses an extension to a diffeomorphism possessing a robust strange attractor (not hyperbolic) equivalent to a product of a solenoid and a circle.

#### A periodic orbit formula for quantum reactions through transition states

Holger Waalkens (Johann Bernoulli Institute for Mathematics and Computer Science, RUG)

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April 22, 14:50–15:25, Blauwe Zaal

**Abstract:** A system shows reaction type dynamics if it spends a long time in one phase space region (the region of reactants), and only occasionally finds its way through a phase space bottleneck (known as a transition state in the chemistry literature) to another phase space region (the region of products). In the context of Hamiltonian

systems the transition states are induced by saddle type equilibrium points. In the talk we will discuss the phase space structures which control the classical transport through transition states, and show how they can be constructed from a normal form. This in particular leads to a realization of transition state theory which is the most widely used approach to compute reaction rates from the phase space flux through a dividing surface separating reactants and products. We will show that a quantization of the (classical) normal form transformation leads to an efficient algorithm to compute quantum reaction rates. We will see that the so called cumulative reaction probability which is the quantum analogue of the classical flux can be expressed as a sum over periodic orbits associated with the transition state. The talk summarizes joint work with A. Goussev, R. Schubert and S. Wiggins from the University of Bristol.

## 8.2 Meetkunde en topologie

### Cohomology of dihedral quandles

Frans Clauwens (Radboud Universiteit Nijmegen)

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April 22, 13:30–14:05, Megaron

**Abstract:** A *rack* is a set  $X$  equipped with a map  $\star: X \times X \rightarrow X$  such that  $a \mapsto a \star b$  is invertible and  $(a \star b) \star c = (a \star c) \star (b \star c)$ . It is a *quandle* if  $a \star a = a$ . An example is a conjugacy class in a group, where  $a \star b = b^{-1}ab$ . Rack and quandle cohomology have been applied to study generalized knots.

We present the first complete description of the cohomology of a nontrivial quandle: the dihedral quandle  $X = D_p - C_p$ . In this case the  $\mathbb{Z}/p\mathbb{Z}$  rack cohomology is freely generated by two classes using the cup-product and a graded Rota-Baxter operator. The quandle cohomology has a similar description where the RB operator has square zero. This result confirms two conjectures by M. Niebrzydowski and J. Przytycki.

### Noncommutative geometry and some of its applications

Walter van Suijlekom (Radboud Universiteit Nijmegen)

April 22, 14:10–14:45, Megaron

**Abstract:** In this talk I will give a short introduction to noncommutative geometry. This mathematical field was founded by the French mathematician Alain Connes in the 1980s and has by now become an active field of research. It has many applications in analysis, geometry, number theory and physics. By means of some key examples I will illustrate the main idea of a noncommutative Riemannian manifold and stress the

important role played by the Dirac operator. As an operator in Hilbert space, it generalizes the metric on an ordinary Riemannian (spin) manifold. In fact, there is a theorem that completely characterizes Riemannian spin manifolds in terms of functional analytical data. Finally, I will present some of my own research. These involve applications of noncommutative geometry to quantum group theory and complex geometry.

### **Almost complex structures for quasi-toric manifolds**

Dietrich Notbohm (Vrije Universiteit Amsterdam)

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April 22, 14:50–15:25, Megaron

**Abstract:** Smooth toric complex varieties provide a large class of quasi toric manifolds, which are manifolds with a “nice” action by a torus whose dimension is half of the dimension of the manifold. In particular, “nice” means that the quotient space is a polytope. We will discuss the question to which extent one can implement an almost complex structure on quasi toric manifolds, that is a complex structure on the tangent bundle of the manifold. In fact we will ask for equivariant almost complex structures. We will give a complete classification for such structures. Both, existence as well as classification can be characterized in terms of Euler classes. Non-equivariantly, the answer is known and part of the folklore.

This is joint work with N. Dobrinskaya

## **8.3 Stochastiek**

### **Non-Markovian chains**

Roberto Fernandez (UU)

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April 22, 13:30–14:05, Rode Zaal

**Abstract:** Non-Markovian chains are discrete-time stochastic processes whose transition probabilities depend on the whole past. Their distinguish feature is the presence of multiple invariant measures, a phenomenon analogous to first-order phase transitions in statistical mechanics. I will review a number of key issues of their theory which seem to have acquired renewed interest. They include uniqueness criteria, relation with one-dimensional Gibbs measures, Markov approximations, regenerative construction and perfect simulation schemes.

**Simulation-based computation of the workload correlation function in a Lévy-driven queue**

Michel Mandjes (Korteweg-de Vries Institute, University of Amsterdam)

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April 22, 14:10–14:45, Rode Zaal

**Abstract:** In this paper we consider a single-server queue with Levy input, and in particular its workload process  $Q(t)$ , focusing on its correlation structure. With the correlation function defined as  $r(t) := \text{Cov}(Q(0), Q(t))/\text{Var}Q(0)$  (assuming the workload process is in stationarity at time 0), we study its transform  $\int_0^\infty r(t)e^{-\theta t} dt$ , both for the case that the Levy process has positive jumps, and that it has negative jumps. These expressions allow us to prove that  $r(t)$  is positive, decreasing, and convex, relying on the machinery of completely monotone functions. For the light-tailed case, we estimate the behavior of  $r(t)$  for  $t$  large. We then focus on techniques to estimate  $r(t)$  by simulation. Naive simulation techniques require roughly  $1/r(t)^2$  runs to obtain an estimate of a given precision, but we develop a coupling technique that leads to substantial variance reduction (required number of runs being roughly  $1/r(t)$ ). If this is augmented with importance sampling, it even leads to a logarithmically efficient algorithm. (This talk is based on joint work with P.W. Glynn, Stanford)

**Asymptotic results for nonparametric Bayes procedures**

Harry van Zanten (Eindhoven University of Technology)

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14:50–15:25, Rode Zaal

**Abstract:** In recent years, nonparametric Bayes procedures have become increasingly popular in applied statistics, in a wide variety of applied fields. It is possible to construct a mathematical framework for studying such procedures, allowing among others the development and investigation of optimality concepts, and the comparison of the performance of different procedures. Mathematical results obtained within this framework can shed light on the performance of Bayesian methods used in practice and can guide the development of procedures that are optimal in an appropriate sense. In this talk we give recent examples of the type of statements that can be obtained. We will focus on recent work on so-called location-scale mixture priors, with applications to statistical problems in astronomy.

## 8.4 Biowiskunde

### Mathematics meets neuroscience

Mathisca de Gunst (Vrije Universiteit Amsterdam)

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April 23, 10:45–11:20, Blauwe Zaal

**Abstract:** Modeling and analysis of biological networks is currently a hot topic. With a couple of examples of stochastic modeling and statistical analysis in the area of neuroscience I will illustrate the role mathematics can play in this field.

### Looking for sparse genetic needles in high-dimensional haystacks

Ernst Wit (University of Groningen)

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April 23, 11:25–12:00, Blauwe Zaal

**Abstract:** As the result of the ever decreasing cost of measuring and storing data, the amount of real information – defined as non-spurious relationships between variables – has become ever sparser. Traditional low dimensional inferential schemes, whereby one aimed to learn about the world by means of multiple observations for each parameter, are being replaced by high-dimensional ones, where the number of parameters far outstrip the number of observations. Nevertheless, often scientific rational in the spirit of Occam’s razor suggests that the desired explanation has to be low-dimensional. This talk will explore how statistics deals with the relationship between the number of observations  $n$ , the number of parameters  $p$  and the dimensionality of the desired model  $d$  in the context of modern genomics.

### Reverse engineering of the auxin transport process in Arabidopsis plants

Sander Hille (Leiden University)

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April 23, 12:05–12:40, Blauwe Zaal

**Abstract:** In plants the growth hormone auxin is transported from the top of the plant downwards through the stem. In various experiments in the Plant Dynamics Lab (PDL) at Leiden University the dynamical properties of this transport mechanism at macroscopic level are measured for the model plant *Arabidopsis thaliana*. We will discuss these experimental results and the various ways we needed to model the system mathematically in the form of a system of coupled ordinary and partial differential equations in order to fit the available data. Moreover, we will present how well-designed macroscopic measurements and mathematical modeling together, in close collaboration with the experimental biologists at PDL, are able to draw conclusions on the structure and functioning of the system at mesoscopic – cellular – level.

## 8.5 Geschiedenis van de wiskunde

### **Leve de Republiek! De Antwerpse rekenmeesters ten tijde van de godsdienstoorlogen**

Ad Meskens (Artesis Hogeschool Antwerpen)  
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April 23, 10:45–11:20, Megaron

**Abstract:** This talk will be held in Dutch. In 1550 the economic outlook for Antwerp was bright. The city boasted a well-educated population. The number of arithmetic teachers (rekenmeesters) (in absolute as well as relative terms) exceeded that of any other Western European town. Combined with a flourishing printing trade we can draw an accurate picture of their trade.

The Iconoclasm of 1566 was the beginning of a new, uncertain era. When in 1585 Antwerp fell to the Spaniards, a real exodus took place. Many of the arithmetic teachers fled north and rebuilt their schools in the now prospering towns of Holland.

In this talk we will discuss the content of the arithmetic books and how they contributed to the lively mathematical scene in 17th century Holland.

### **Kennistransformatie in de vroege Republiek / Knowledge transformation in the early Dutch Republic**

Steven Wepster (Universiteit Utrecht)  
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April 23, 11:25–12:00, Megaron

**Abstract:** This talk will be held in Dutch. In the second half of the sixteenth Century, the Northern Low Countries experienced a boost in many areas including mathematics, due to the influx of intellectuals from the South. Initially, mathematics was the domain of the reckoning masters, who had a lively exchange of problems and solutions partly to challenge each other's abilities. Gradually a more scholarly interest in mathematics grew also. This implied that mathematics was increasingly studied by persons who had access to the classical (mathematical) literature. Thus, the same old problems were studied under different circumstances. What changed, and what remained the same? How did the reckoning masters and the scholars interact? We will study these questions through a number of case studies.

### **Drukkers en uitgevers en de verspreiding van wiskunde in de zeventiende eeuw**

Djoeke van Netten (Universiteit van Amsterdam)  
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April 23, 12:05–12:40, Megaron

**Abstract:** This talk will be held in Dutch. Science, and especially mathematical science, flourished in the Dutch Republic in the seventeenth century. Besides refugees from the Southern Netherlands more and more indigenous mathematicians became active. We know of their existence because of what they left behind: the books they had written or composed.

All these books however (arithmetic books and pilot guides as well as the new theories of Galileo and Descartes) not only had to be written; they had to be made. Who took care of that? A lot of printers and publishers took part in the producing and distributing of mathematical books in the Dutch Republic and they built up its scientific infrastructure.

An outstanding example (not by its representativity but by its particular output) is Willem Jansz Blaeu (1571-1638). He can be seen als the biggest producer of mathematics in the Dutch Republic in the first half of the seventeenth century and as a printer-publisher-bookseller and a mathematician he stood at a very interesting intersection of the aforementioned infrastructure.

The question is, what did mathematics-producers like Blaeu contribute to the science of their times and by what motivation were they driven?

## 8.6 Impact nieuwe ICT-mogelijkheden

### The atlas of Lie Groups and representations project and software

Marc van Leeuwen (Poitiers)

April 23, 10:45–11:20, Rode Zaal

**Abstract:** The Atlas of Lie Groups and Representations project is an international collaboration of mathematicians (administered and funded in the U.S.A.), aiming to make available information about representations of reductive Lie groups over real and p-adic fields. In order to do so, both theoretical and computational methods are employed; an important part of the project is the development of a software tool that allows computations with various types of (combinatorial) structures that are relevant to Lie groups and their representations. The project has received considerable media attention in 2007, when this software achieved the computation of the Kazhdan-Lusztig-Vogan polynomials for the split real group of type  $E_8$ . The purpose of this talk is to give some insight in the way mathematical activity and computer technology interact in this project, without going into too much details of the mathematics involved.

### **High Resolution Simulation of the Global Ocean Circulation**

Henk Dijkstra (Institute for Marine and Atmospheric research Utrecht, Utrecht University)

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April 23, 11:25–12:00, Rode Zaal

**Abstract:** The Atlantic Ocean Circulation is sensitive to the patterns of its forcing, in particular to that of the freshwater flux. Relatively small changes in atmospheric conditions or meltwater inflow may therefore lead to a spectacular reduction (collapse) of the meridional heat transport caused by Atlantic Ocean currents. As such a collapse can happen in only a few decades, it may have a large impact on European climate and society. In low-resolution ocean-climate models, such collapses have been found but the variability of the meridional heat transport in these models is much smaller than that recently observed. In this presentation I will present results of simulations of the response of the global ocean circulation to (Greenland Ice Cap) meltwater inflow using a high resolution (10 km horizontal grid spacing) global ocean model. The focus of the talk will be on several aspects of scientific computing (e.g., model structure, parallel implementation, load balancing) in carrying out these simulations.

### **Prize-collecting Steiner trees in protein interaction networks**

Gunnar W. Klau (Centrum Wiskunde & Informatica)

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April 23, 12:05–12:40, Rode Zaal

**Abstract:** In modern biomedicine, gene expression profiling has become a well-established tool for disease classification and subtyping. However, cellular functions cannot be understood on an isolated level, but need to be studied in the context of a protein interaction network. Of particular interest is the identification of novel functional modules in these networks, sharing common cellular function beyond the scope of classical pathways, by means of detecting differentially expressed network regions under different conditions. This requires on the one hand an adequate scoring of the nodes in the network to be identified and on the other hand the availability of an effective algorithm to find maximally scoring network regions.

We present the first exact solution for this problem, which is based on a sound statistical score definition and an unusual connection to the well-known prize-collecting Steiner tree problem, which also appears in network design. Despite the complexity of the underlying combinatorial problem, our method typically computes provably optimal subnetworks in large networks in a few minutes. We have applied our algorithm to data from a well-established lymph cancer study involving 194 patients suffering from

two different lymphoma subtypes. Our algorithm discovers biologically meaningful dysregulated modules, which include and extend modules that are well-known for the pathogenesis of the two tumor subtypes.

## 8.7 Getaltheorie

### **Weil-etale cohomology of regular arithmetic schemes**

Matthias Flach (California Institute of Technology, currently MPI Bonn)

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April 23, 13:45–14:35, Blauwe Zaal

**Abstract:** The subject of the talk is the relationship between values of motivic L-Functions, or Zeta-functions, of arithmetic schemes and cohomology theories attached to such schemes. Examples of such relationships are the analytic class number formula or the conjecture of Birch and Swinnerton-Dyer. We first explain Lichtenbaum's idea of Weil-etale cohomology, briefly discuss definitions and results for varieties over finite fields, and then report about joint work with Baptiste Morin on a tentative definition of a Weil-etale topos for arbitrary regular arithmetic schemes. Our main result is that our definition yields the expected cohomology with  $\mathbb{R}$ -coefficients. If time permits we also discuss the relationship of this approach with previous ideas on special values of L-functions, notably the Tamagawa number conjecture of Bloch and Kato.

### **Arithmetic of K3 surfaces**

Matthias Schütt (Hannover)

April 23, 14:45–15:35, Blauwe Zaal

**Abstract:** K3 surfaces have recently seen great progress on the arithmetic side. In this talk, we will review some recent developments with emphasis on rational points and modularity. All questions will be motivated on the basic level of algebraic curves. We will also point out why K3 surfaces are singled out among algebraic surfaces for arithmetic considerations.

## 8.8 Leraar en wiskunde

### **Bestaat toeval (anno 2010)?**

Klaas Landsman (Nijmegen)

April 23, 13:45–14:20, Megaron

**Abstract:** Alle vormen van waarschijnlijkheid die men in het dagelijks leven tegenkomt zijn een gevolg van onze onwetendheid, en niet van echt of intrinsiek toeval (denk aan dobbelen of een loterij). Bestaat waarachtig toeval eigenlijk wel? Deze vraag was tussen 1925 en 1935 inzet van een verhit debat tussen Albert Einstein en Niels Bohr, de twee grootste fysici van de twintigste eeuw. Einstein stelde dat God niet dobbelt; Bohr maande hem niet te dicteren hoe God (waarmee beiden in feite de natuur bedoelden) zich te gedragen had. Dit debat leek in eerste instantie te verzanden, maar kreeg in 1964 weer schot door het werk van John Bell en de naar hem genoemde ongelijkheden. Deze waren het onderwerp van mijn oorspronkelijke voordracht op de Nationale Wiskunde Dagen van 2006. Sindsdien is een scherper argument voor zuiver toeval dan dat van Bell op de markt gekomen, namelijk de bijzonder fraaie “Vrije Wil Stelling” van John Conway en Simon Kochen. Deze zal nu aan bod komen, opnieuw op een manier die ook aan scholieren is uit te leggen. Hoe dan ook is en blijft het mooie van het verschijnsel toeval dat het enerzijds in ieders belevingswereld voorkomt, terwijl het anderzijds met grote wiskundige diepgang besproken kan worden.

### **Het wiskundige brein van de mier**

Bob Planqué (VU)

April 23, 14:25–15:00, Megaron

**Abstract:** Kolonies mieren vormen een van de wonderen der natuur, met zijn duizenden nietige insecten die complexe maatschappijen vormen, altijd hard werken, en zeer goed georganiseerd zijn. Ze zijn volgens sommige biologen de eigenlijke uitvinders van de landbouw en hebben miljoenen jaren geleden al een industriële revolutie ondergaan. Maar hoe slim zijn mieren eigenlijk? Met andere woorden, hoeveel van de complexiteit op kolonieniveau valt toe te schrijven aan de complexiteit van de individuele mier? De wiskunde vormt, samen met experimentele biologie, een belangrijk onderdeel in het onderzoek naar deze vragen. Hierbij zal een aantal fenomenen aan het licht komen waarin het wiskundig karakter van mieren als individu of als kolonie wordt bekeken. Mieren blijken bijvoorbeeld een verbazingwekkend simpel maar krachtig algoritme te gebruiken om groottes van ruimtes te schatten, gerelateerd aan een bekende manier om pi te benaderen. Op het collectieve niveau gebruiken mieren ook verschillende vormen van gedrag om informatie over te dragen, en zich binnen in het

nest te organiseren. We zullen een aantal wiskundige modellen bekijken, meestal gebruikmakend van eenvoudige differentiaalvergelijkingen. Onderwerpen die hier de revue zullen passeren zijn emigraties van kolonies naar nieuwe nesten, het collectief zoeken naar voedsel en de organisatie van de mierenkolonie binnen in het nest. De nadruk komt hierbij te liggen op het bespreken van de verschillende soorten modellen (stochastisch of deterministisch), en de inzichten die elk type te bieden heeft.

### **Mathematics and the groove in music**

Anja Volk (UU)

April 23, 15:05–15:40, Megaron

**Abstract:** (lezing in het Nederlands) The relation between mathematics and music has a long history in science. It comprises diverse approaches such as the Pythagorean School, the study of music in the medieval sciences, the works by Rene Descartes, Gottfried Wilhelm Leibniz, Leonhard Euler or Hermann von Helmholtz, and it attracted an intensified interest since the late 20th century. Music theorists discovered mathematics as a powerful means to describe structural approaches to music and thus created the field of Mathematical Music Theory. Sound technology used applied mathematics to analyze and synthesize musical sound, computer science and cognitive approaches made use of mathematical descriptions of music. In this talk we present a recent mathematical model on the temporal organization of musical pieces that roots in Mathematical Music Theory. The model of Inner Metric Analysis measures the strength of certain pulses inherent in the music in order to determine a metric weight for each note of a musical piece that describes its contribution to regularity in time. The corresponding metric weight profile for a piece of music then allows the exploration of different questions related to the rhythmic-metric structure of the piece, such as to why it is easy or difficult to tap along a certain type of music. We will discuss applications of Inner Metric Analysis to problems residing in different research areas that make use of mathematical modeling such as music theory, cognition and retrieval.

## **8.9 Scientific computing**

### **Graph algorithms in the electronics industry**

Joost Rommes (NXP Semiconductors)

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April 23, 13:45–14:20, Rode Zaal

**Abstract:** Electro Static Discharge (ESD) analysis is of vital importance during the design of large-scale integrated circuits, since it gives insight in how well the interconnect can handle unintended peak charges. Due to the increasing amount of interconnect and

metal layers in advanced CMOS chip designs, ESD analysis may become very time consuming or even unfeasible. In this talk we will explain the underlying mathematical problem and we will show how numerical methods and graph algorithms can be used to enable and speed-up large-scale ESD analysis. We propose an algorithm for the reduction of large resistor networks, that typically arise during ESD analysis, to much smaller equivalent networks. Experiments with industrial designs show reduction and speed-ups up to a factor 1000.

### **On an Efficient Method for Pricing Financial Options on the Graphics Processing Unit**

Cornelis W. Oosterlee (CWI, Centrum Wiskunde & Informatica, Amsterdam, the Netherlands, and Delft University of Technology, Dept. Applied Mathematics, Delft.)

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April 23, 14:25–15:00, Rode Zaal

**Abstract:** Abstract: In this presentation we discuss mathematical methods for efficient pricing of financial derivatives in Computational Finance. In particular we look at the Heston model with and without stochastic interest rates. We present approximations in the Heston-Hull-White hybrid model, so that a characteristic function can be derived and derivative pricing can be efficiently done using the Fourier Cosine expansion technique. This pricing method, called the COS method, is explained in some detail. We show that pricing of options for calibration purposes can be efficiently done on the Graphics Processing Unit.

### **Linear discrete ill-posed problems and image deblurring**

Michiel Hochstenbach (TU Eindhoven)

<http://www.win.tue.nl/~hochsten/>

April 23, 15:05–15:40, Rode Zaal

**Abstract:** Many fields and applications (e.g., inverse problems and image deblurring) lead to so-called linear discrete ill-posed problems: linear systems or least squares problems of the form

$$Ax = b, \quad A \in \mathbb{R}^{m \times n}, \quad x \in \mathbb{R}^n, \quad b \in \mathbb{R}^m,$$

where  $A$  is “numerically singular” ( $A$  often has many tiny singular values). A further problematic aspect is that  $b$  usually has an error (“noise”), which may stem from discretizations or measurement inaccuracies. The challenge is to get a quality approximation  $x$ , while avoiding the error in  $b$  to blow up due to the near-singularity of  $A$ . In this talk we give an overview of several approaches for this problem, and we also describe current work. We will use the methods in an attempt to deblur some images.

## 8.10 Freudenthal's selecta

Looking back at Freudenthal's journey through the realm of mathematics, one cannot but feel a mixture of awe and amazement. The number and diversity of topics he dealt with, entitle him to a place of honor among the twentieth century mathematicians.

Freudenthal was a typical product of the German humanist, intellectual tradition that was so tragically curtailed in 1933. He got his mathematical training in Berlin from such authorities as Bieberbach, Erhard Schmidt, Hopf, Feigl, Loewner and von Neumann.

Schmidt and Hopf introduced him to the modern topology of the day; the latter became his Ph.D. advisor. After finishing his dissertation, he was invited by Brouwer – who had been impressed by Freudenthal's knowledge of both topology and intuitionism – to become his assistant in Amsterdam. From then on his career took place among the Dutch.

The Selecta concentrates on the major contributions of Freudenthal, to wit topology, Lie groups, topological groups, geometry (mostly in connection with Lie theory), foundations and the history of mathematics. Furthermore a paper on formal linguistics, *Lincos* has been included. Freudenthal's first results in topology from his dissertation, which dealt with the theory of ends; – a theory that yielded compactifications – open the Selecta. The prewar papers on topology and functional analysis (e.g. vector lattices) are all from his Amsterdam period. They deal with a number of topics that belong to the Brouwer-Alexanderov-Hopf tradition, e.g. dimension theory, limits of spaces. Papers that made his name in homotopy theory have benefited from his cooperation with Hurewicz (at the time another one of Brouwer's assistants). The paper on mappings of spheres, with the well-known *Freudenthal suspension*, bearing witness to an important period in Freudenthal's topological career, is also included. The postwar period in Freudenthal's research is represented in the Selecta by his work on exceptional Lie groups and their connection with geometry. This theme stands out as a major contribution to the area, which has attracted a great deal of attention. From Freudenthal's historical oeuvre we have adopted his erudite and informative overview of Hilbert's Grundlagen.

The fact that the Selecta confines itself to the above mentioned central topics in Freudenthal's oeuvre, should not hide his amazing production of papers on all subject under the mathematical sun. One might think of his work on statistics, physics, history, and last but not least, on mathematical education. He also found time to write a number of successful books on various topics; books that were translated in many languages.

Freudenthal will be remembered as the universal mathematician he was, with a vivid interest and knowledge of history, culture and politics.

We may say that it was his strong personality that prevented him from being locked up in in particular compartment of mathematics – he had an irresistible urge to explore new subjects, meet new people, and to inspire his students.

### **Hans Freudenthal - universalist and specialist**

Dirk van Dalen (Utrecht University)

Dirk.vanDalen@phil.uu.nl

April 23, 14:25–15:00, Zaal A

**Abstract:** Freudenthal was a master of many, if not all, trades. He contributed to a large number of topics in mathematics and adjoining fields. In this talk we will pay attention to the history and personality of the man, and the connection with his contributions to mathematics in the widest sense.

### **Freudenthal and Lie theory**

Tonny A. Springer (University of Utrecht)

T.A.Springer@uu.nl

April 23, 15:05–15:40, Zaal A

**Abstract:** Hans Freudenthal (1905-1990) published between 1933 and 1970 about 40 technical papers on Lie theory (the theory of Lie groups and its ramifications). In this brief talk I will try to give an idea of this work and of its present-day status.

## **8.11 De boekerij van het KWG**

### **Het erfgoed van het Koninklijk Wiskundig Genootschap**

Astrid Balsem (adjunct-conservator Bijzondere Collecties, Universiteit van Amsterdam)

A.C.Balsem@uva.nl

April 23, 13:45–14:20, Zaal A

**Abstract:** Sinds 1880 berust de collectie handschriften, boeken en tijdschriften van het KWG als bruikleen in de bibliotheek van de Universiteit van Amsterdam. Sinds 2007 heeft de Universiteit van Amsterdam haar museale - en bijzondere bibliotheekcollecties, waaronder die van het KWG, ondergebracht in een nieuwe organisatie met een nieuwe naam: UvA Erfgoed.

De presentatie beoogt een hernieuwde kennismaking met de Boekerij van het KWG, die aan de afdeling Bijzondere Collecties van UvA Erfgoed is toevertrouwd. Tevens gunt zij een kijkje achter de schermen van de bibliotheek van de Bijzondere Collecties aan de Oude Turfmarkt 129 te Amsterdam, waar de grootste kostbaarheden van het KWG volgens de nieuwste inzichten worden bewaard en beschikbaar zijn voor onderwijs en onderzoek.

## 9 NMC-lokaties 1965 t/m 2009

Jaar	Nr.	Plaats	Opmerking
1965	1	Enschede	
1966	2	Heerlen	
1967	3	Nijmegen	
1968	4	Eindhoven	
1969	5	Wageningen	
1970	6	Delft	
1971	7	Amsterdam	UvA
1972	8	Groningen	
1973	9	Leiden	
1974	10	Enschede	
1975	11	Utrecht	
1976	12	Amsterdam	VU
1977	13	Rotterdam	
1978	14	Amsterdam	VU
1979	15	Eindhoven	
1980	16	Nijmegen	
1981	17	Amsterdam	1e dag op UvA, 2e dag op CWI
1982	18	Wageningen	
1983	19	Delft	
1984	20	Groningen	
1985	21	Leiden	
1986	22	Enschede	
1987	23	Utrecht	
1988	24	Eindhoven	
1989	25	Amsterdam	VU
1990	26	Nijmegen	
1991	27	Rotterdam	
1992	28	Delft	
1993	29	Amsterdam	UvA
1994	30	Leiden 7	
1995	31	Groningen	
1996		Antwerpen	AMS Benelux, 22-24 mei 1996 georganiseerd door de American, Belgian, Dutch and Luxemburg mathematical societies. In de volgende jaren is dit congres aanvankelijk niet meegeteld als NMC (althans volgens de programmaboekjes), maar Maastricht heeft dit geredigeerd door niet 35e, maar 36e NMC op zijn boekje te zetten.

1997	32	Wageningen	
1998	33	Enschede	
1999	34	Utrecht	
2000	36(!)	Maastricht	
2001	37	Amsterdam	aan de VU, gezamenlijk georganiseerd door VU en CWI
2002	38	Eindhoven	
2003	39	Nijmegen	
2004	40	Tilburg	
2005	41	Gent	in samenwerking met de zusterorganisaties uit België, Frankrijk en Luxemburg.
2006	42	Delft	gezamenlijk georganiseerd door TUD en UL.
2007	43	Leiden	gezamenlijk georganiseerd door TUD en UL.
2008	44	Amsterdam	onderdeel van het 5-th European Congress of Mathematics
2009	45	Groningen	
2010	46	Utrecht	

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## Internationale Wiskunde Olympiade 2011 in Nederland

De Internationale Wiskunde Olympiade is een prestigieuze wiskundewedstrijd voor middelbare scholieren. Het is de oudste en grootste van de wetenschapsolympiades die internationaal worden georganiseerd. De 52e Internationale Wiskunde Olympiade zal in juli 2011 in Amsterdam worden gehouden. In totaal worden ongeveer 600 deelnemers uit meer dan 100 landen verwacht (en daarnaast nog een paar honderd begeleiders). De wedstrijd bestaat uit het oplossen van zes pittige wiskundeopgaven verdeeld over twee wedstrijddagen.

## Vrijwilliger zijn bij het grootste internationale Wiskunde-evenement?

### Word gids of wedstrijdbegeleider bij de International Mathematical Olympiad in 2011

#### Vrijwilligers nodig

Rond de wedstrijd worden excursies en activiteiten voor de internationale groep deelnemers georganiseerd. Ook is er een officiële opening- en sluitingsceremonie. De deelnemers zijn negen dagen in Nederland en worden vanaf hun aankomst tot vertrek begeleid door een gids van het organiserende land. Naast de in totaal 1.000 buitenlandse gasten nemen er ook zo'n 300 vrijwilligers aan het evenement deel, die ervoor zorgen dat alles goed loopt. Dit zal een onvergetelijke ervaring zijn. Wil jij ook je handen uit je mouwen steken in 2011?

Er zijn allerlei taken die door vrijwilligers tijdens de IMO worden verricht.

- De gidsen begeleiden elk een team van zes deelnemers uit één land en helpen hen met praktische zaken. Voor deze functie zijn we vooral op zoek naar studenten die hun buitenlandse talen goed spreken.
- De wedstrijdbegeleiders zorgen dat de wedstrijd vlekkeloos verloopt. Voor deze functie zijn we vooral op zoek naar docenten.
- De crewleden regelen alles op de accommodaties.
- De coördinatoren kijken het werk van de deelnemers na en stellen in overleg met de teamleiders de scores vast.

**Meer informatie? Aanmelden voor een van de functies? Kijk op [www.imo2011.nl](http://www.imo2011.nl).**



**De Yellow Sale van Springer is weer begonnen!  
Kom voor deze en nog veel meer aantrekkelijke wiskunde titels  
naar selexyz broese de Uithof, Heidelberglaan 2.  
In hetzelfde complex als het congres, binnendoor te bereiken.**