

PROGRAMME

55th edition

Nederlands Mathematisch Congres

23-24 April 2019
Conference Center
Koningshof, Veldhoven



Barbara Gentz
random dynamical systems



Jan Hesthaven
scientific computing



Gábor Lugosi
statistics, information theory



Anke van Zuylen
combinatorial optimisation

Sponsors

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NMC 2019

Programme Booklet

Veldhoven, The Netherlands

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Mark van Assem (NWO)

Juul Brouwers (NWO)

Marieke Kranenburg (University of Amsterdam)

André Ran (Vrije Universiteit Amsterdam, on behalf of KWG)

Wil Schilders (PWN, TU Eindhoven)

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Ronald de Wolf (CWI, University of Amsterdam)

KWG-PhD prize committee:

Gerard van der Geer (University of Amsterdam)

Alessandra Cipriani (TU Delft)

Alessandro Di Bucchianico (TU Eindhoven)

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Word of Welcome

Dear Participant,

Welcome at the 55th edition of the Nederlands Mathematisch Congres (NMC), organised under the auspices of the Koninklijk Wiskundig Genootschap. This is the second time that the NMC is organised in its new two-day setting. This NMC has been made possible again through a generous financial support from the Netherlands Organisation for Scientific Research.

We think that the organising committees have composed an interesting programme again, with four plenary lectures by prominent mathematicians, a lecture by the winner of the De Bruijn Prize 2019, four mathematics cluster sessions organised by (per session) two mathematics clusters, five awardings of prizes, a speed dating session with representatives from companies offering job opportunities, a congress dinner, a dance performance, and more. Last but not least, NMC 2019 offers its participants the opportunity to come, speak and work together.

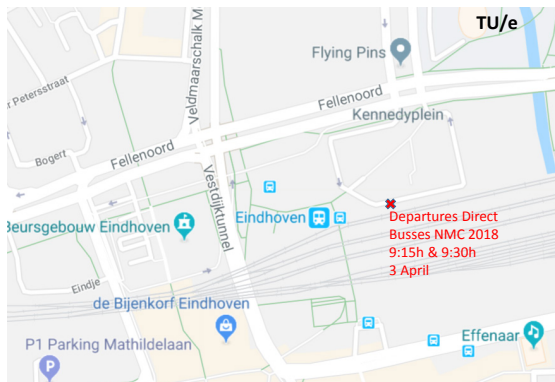
We wish you a pleasant and successful NMC 2019!

Barry Koren (chairman scientific organising committee)
Evgeny Verbitskiy (chairman local organising committee)

General Information

Venue: NH Koningshof, Veldhoven

There will be two dedicated buses going from Eindhoven Railway Station to the conference location NH Koningshof in the morning of April 23—one at 9:15 and another at 9:45. The buses depart from the north side (TU/e side) of the Station. At other times take the Bus 19/319 to Koningshof. The bus trip takes about half an hour.



Wireless internet is available at NH Koningshof (no password required).

On Wednesday, April 24, there will be two buses returning to Eindhoven Railway Station—one at 18:15 and the other at 18:45.

Food and beverages, evening programme

Lunches are included in the registration fee, as is the conference dinner. The lunches and coffee breaks will be served in the Limburg and Meijerij foyers. The conference dinner will be served in De Uithof. The evening programme will be in the Brabant hall, followed by the possibility to have drinks and a chat in the Abdij bar.

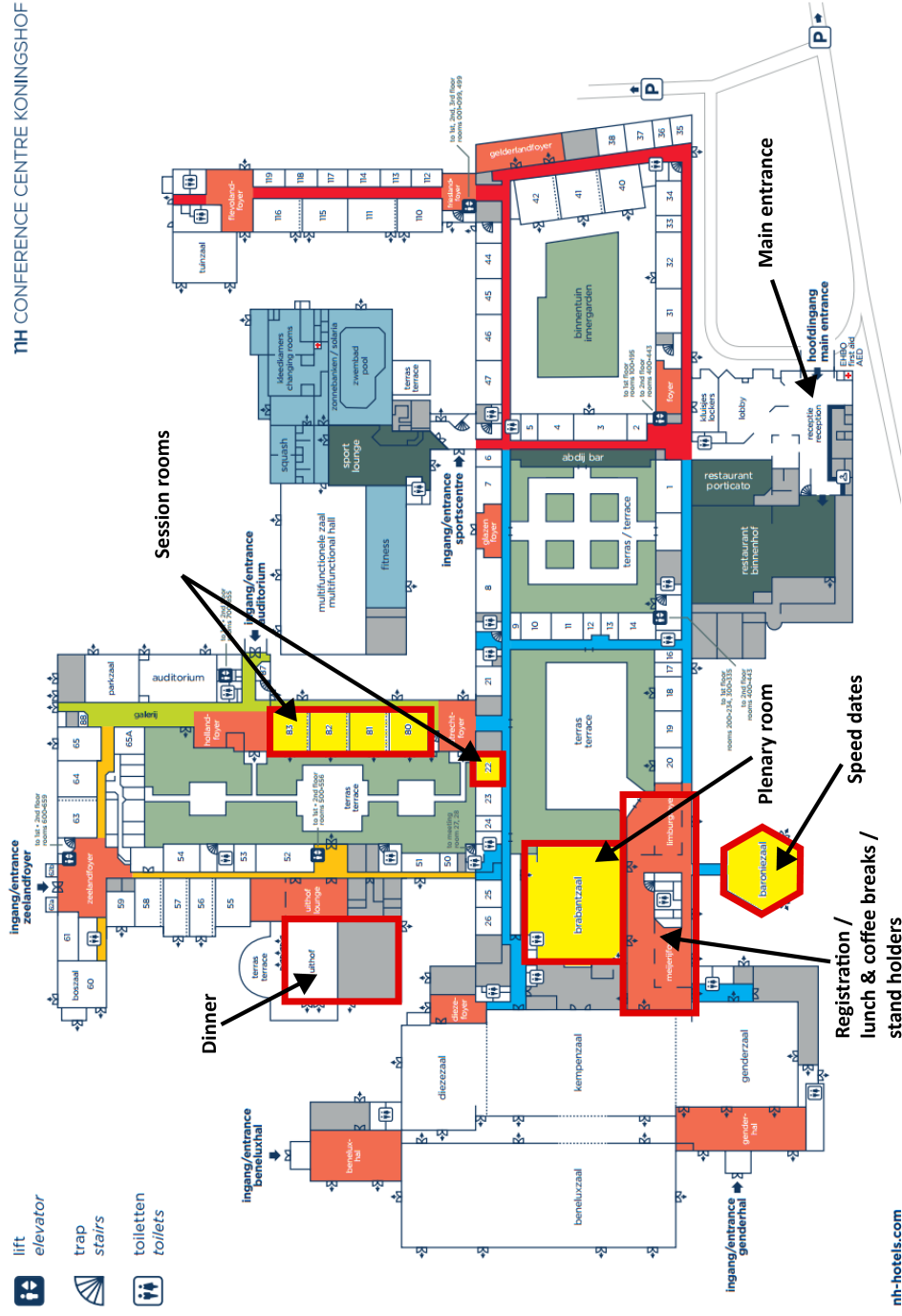
Registration desk

Should you have any questions or encounter any problems, please contact the registration desk which will be open during early mornings and the breaks. The hotel registration desk is open full time for non-conference-related questions.

Stands

In the Limburg and Meijerij foyers there will be stands of the following organisations:

- Epsilon Uitgaven
- European Women in Mathematics - NL (EWM-NL)
- Koninklijke Nederlandse Biljart Bond (KNBB) - Smartpool project
- Moravia Europe
- Nederlandse Vereniging voor Wiskundeleraren (NVvW)
- NWO
- Optische Fenomenen
- Platform Wiskunde Nederland (PWN)
- Vierkant voor Wiskunde



Programme Outline

Tuesday, April 23

Time	Location	Activity
9:30-10:30	Limburg/Meijerij foyer	Registration & coffee
10:30-10:45	Brabant hall	Opening by Jan Wiegerinck (chair of KWG) Bas Zwaan (board member of ENW ¹) Janne Brok (Sioux LIME)
10:45-11:45	Brabant hall	Plenary lecture by Jan S. Hesthaven <i>Structure preserving reduced order models</i>
11:45-13:30	Limburg/Meijerij foyer Lecture hall Z 83	Lunch KWG Annual meeting
13:30-15:00	Lecture hall Z 80 Z 81 Z 82	Parallel sessions: DIAMANT–GQT NDNS+–STAR 4TU.AMI Session
15:00-15:30	Limburg/Meijerij foyer Lecture hall Z 83	Coffee break Presentations for MSc Prize of PWN Innovation
15:30-16:40	Brabant hall	Laudatio by Jan van Neerven De Bruijn lecture by Dion Gijswijt <i>Cap sets and new applications of the polynomial method</i>
16:40-16:45	Brabant hall	Ceremony of MSc Prize of PWN Innovation by Vivi Rottschäfer
16:45-17:00	Limburg/Meijerij foyer	Short break
17:00-18:00	Brabant hall	Plenary lecture by Barbara Gentz <i>Noise in coupled dynamics—friend or foe?</i>
18:00-19:00	Limburg/Meijerij foyer Baronie hall	Drinks Speed dates with Industry
18:20-19:00	Lecture hall Z 80	EWM-NL session: EWM-NL activities in 2018 Exchange: Experiences and career path
19:00-21:30	De Uithof	Dinner
21:30-22:30	Brabant hall	Lecture Performance on ‘spurs’ of Lehmer
22:30-01:00	Abdij Bar	Drinks

¹NWO Domain Science

Wednesday, April 24

Time	Location	Activity
08:30-09:00	Limburg/Meijerij foyer	Registration & coffee
09:00-10:00	Brabant hall	Plenary lecture by Anke van Zuylen <i>Improved tours and paths for the traveling salesman</i>
10:00-11:00	Brabant hall	Strategy session: Sector plan Assessment Mathematics Clusters PWN Committee on Innovation
11:00-11:30	Limburg/Meijerij foyer	Coffee break
11:30-13:00	Lecture hall Z 80 Z 81 Z 22 Z 82 Z 83	Parallel sessions: DIAMANT-STAR GQT-NDNS+ History of Differential Geometry NETWORKS Quantum Software Consortium
13:00-14:00	Limburg/Meijerij foyer	Lunch
14:00-16:00	Brabant hall	Award lectures: KWG-PhD Prize competitors Stieltjes Prize winners 2017 & 2018
16:00-16:30	Limburg/Meijerij foyer	Coffee break
16:30-17:30	Brabant hall	Plenary lecture by Gábor Lugosi <i>Many questions and a few answers in network archeology</i>
17:30-18:00	Brabant hall	Closing with prize ceremony: KWG-PhD Prize Stieltjes Prize Pythagoras Prize
18:00-18:30	Limburg/Meijerij foyer	Drinks & snacks

Docentendag, April 24

Time	Location	Activity
14:00-14:45	Lecture hall Z 80	Talk by Jeanine Daems
14:45-15:15	Lecture hall Z 80	Commissie Onderwijs PWN
15:15-16:00	Lecture hall Z 80	Pythagorasprijs
16:00-16:30	Limburg/Meijerij foyer	Coffee break

Further Information of Programme Elements

On the next pages some information is given on the De Bruijn lecture, the Stieltjes Prize, the KWG-PhD Prize, and the annual meeting of the members of the KWG.

About De Bruijn, the De Bruijn Prize, and the lecturer

Prof. dr. N.G. de Bruijn was a Dutch mathematician. He was born in The Hague in 1918, and passed away in Nuenen in 2012. He studied at Leiden University, where he graduated in 1941. In 1943 he received his PhD from the Vrije Universiteit Amsterdam. His thesis was concerned with modular forms in several variables, his thesis advisor was J.F. Koksma. De Bruijn worked at the University of Amsterdam, where he was professor from 1952 to 1960, before moving to the Eindhoven University of Technology, where he remained until his retirement in 1984. He was a member of the Koninklijke Nederlandse Academie van Wetenschappen (Royal Netherlands Academy of Arts and Sciences). De Bruijn was well-known for his fundamental work in several areas of mathematics and his involvement in the Automath project.

The N.G. de Bruijn Prize was established in 2015 by the KWG, the Dutch Royal Mathematical Society. This year, the prize has been awarded to *Dion Gijswijt* for his joint paper with Jordan S. Ellenberg: “On large subsets of $\mathbb{F}_q^n$ with no three-term arithmetic progression,” published in *Annals of Mathematics* 185 (2017), 339-343. This paper settles a well known conjecture in combinatorics with a long history. Gijswijt and Ellenberg solved the conjecture independently and decided to publish the solution in a joint paper. Their solution generated a tremendous buzz within the mathematical community as well as in the popular press and was even covered in many newspapers.

Dion Gijswijt obtained his PhD in 2005 under supervision of Prof. dr. Lex Schrijver at the University of Amsterdam. For his thesis, he was selected as a Tucker Prize finalist awarded triennially by the Mathematical Optimization Society. His research interests are mainly in discrete mathematics, in particular combinatorial optimisation and extremal combinatorics.

About the Stieltjes Prize and the lecturers

On behalf of Stichting Compositio Mathematica, the Stieltjes Prize is awarded annually for the best PhD thesis in mathematics in The Netherlands. All mathematics PhD theses written in The Netherlands automatically participate in the competition.

At NMC 2018 the Stieltjes prize 2016 was awarded. In order to be more actual, it was decided to have two Stieltjes prizes at NMC 2019, namely the

2017 and 2018 prize. The latter was selected from the theses published in January–August 2018. From now on, the Stieltjes prize will be awarded over an academic year. The significant amount of extra work done by the jury this time is highly appreciated. Jury members for the 2017 and 2018 prize were: Odo Diekmann (UU), Aernout van Enter (RUG), Richard Gill (LU), Barry Koren (TU/e), Frans Oort (UU, chairman) and Marc Uetz (UT).

For the 2017 prize, a total of 94 theses was considered. After a first selection, consulting external experts, a shortlist of eight theses was obtained. The jury was impressed by the very high level of the theses, but also unanimous about the selection of one thesis that protruded the rest concerning quality, depth and originality: “Large matroids: enumeration and typical properties” by Jorn van der Pol of TU Eindhoven.

For the 2018 prize, the jury considered 37 theses, and after a first selection, a short list of six was obtained. Again, external experts were consulted. Especially striking in this round was the high quality of the presentation of results. Many of the researchers had an independent and original treatment of the material. After several rounds of discussions, two theses were selected as being the best in this round:

- Souvik Dhara of TU Eindhoven, with the thesis entitled “Critical percolation on random networks with prescribed degrees”.
- Joost Nuiten of Utrecht University, with the thesis “Lie algebroids in derived differential geometry”.

The prize ceremony will be held at the closing session of NMC 2019. All winners will present their work at the NMC 2019.

About the KWG-PhD Prize

On Wednesday afternoon there will be lectures by candidates for the KWG-PhD Prize. The prize ceremony will be held at the closing of the NMC 2019. Four PhD students will have the opportunity to present their work (at most 15 minutes, including questions). At the end of the day, the winner selected by the jury receives a trophy and a cash prize.

The presentations will be aimed at a general mathematical audience, and the student’s ability to make the subject accessible to non-specialists is an important criterion for winning the award. The candidates are recently graduated PhD students in mathematics at a university or research institution in the Netherlands.

The jury consists of Gerard van der Geer (chair, UvA), Alessandra Cipriani (TUD), and Alessandro Di Bucchianico (TU/e).

The KWG-PhD Prize is sponsored by [Bronstee.com](https://www.bronstee.com).

The KWG Annual Meeting

Tuesday, April 23, 11:45-13:30

Lecture hall Z 83

Founded in 1778, the Dutch Royal Mathematical Society (Koninklijk Wiskundig Genootschap) is the oldest of all present-day national mathematical societies. The society serves as professional organisation of the Dutch mathematics community. Besides organising conferences, it also issues journals and magazines such as *Indagationes Mathematicae*, *Nieuw Archief voor Wiskunde* and *Pythagoras*. Together with the Dutch society of mathematics teachers, it participates in Platform Wiskunde Nederland (PWN). The society also represents the Dutch mathematical community internationally in the EMS and IMU.

The annual meeting of the Dutch Royal Mathematical Society is traditionally held during the NMC.

The PWN Innovation MSc Prize

Tuesday, April 23, 15:00-15:30

Lecture hall Z 83

The Committee Innovation of Platform Wiskunde Nederland will award the Best Thesis in Applied Math Award. The award is handed out for a master thesis that has a clear applied mathematical focus. The thesis has been written in close cooperation with an external party, e.g. a company, a governmental institution or a foundation. The submitted theses were all of very high quality. In the first round, three finalists were selected who will have the opportunity to pitch their thesis in this session. The finalists are

- Wessel van Eeghen
- Jasmijn Manders
- Tineke School

During the session, the winner will be chosen by a jury. The prize ceremony will be held on Tuesday, April 23 at 16:40

Speed Dating with Industry

Tuesday, April 23, 18:00–19:00

Baronie hall

Speed dating Event at NMC 2019

The Local Organising Committee has invited companies to delegate employees to provide inspiration, ideas and guidance to PhD students and other participants at the NMC 2019 Speed Dating Event. The session will offer an invaluable opportunity to gain a better understanding of the variety of career paths. Companies are encouraged to talk about the role of mathematics and about job opportunities within their organisation.

On the first day of the NMC, a form will be available to register for the speed dating event. The companies participating are:

- ABN AMRO – www.abnamro.nl

ABN AMRO is an enterprising bank with a primary focus on Northwest Europe. We serve clients in the retail, private banking and corporate banking sectors. In the risk modelling department of ABN AMRO mathematics, statistics and programming play a major role. We need your help, please join us and we explain how.

- ASML – www.asml.com

A leading supplier to the worlds fast-moving semiconductor industry, ASMLs lithography and metrology systems are among the most complex machines ever conceived. Their extreme high performance is being continuously improved with data-rich modeling and healthy physical insight you can be part of such a team of imaginative thinkers who create and innovative ASML products!

- Compumatica – www.compumatica.com

Compumatica is an independent Dutch cybersecurity manufacturer with focus on encryption of network and e-mail traffic and network security/segmentation (firewall & diode technology). Compumatica develops, produces and implements their solutions with a high security grade without backdoors. The solutions have different certifications from The Netherlands, European Union, and NATO. Compumatica is located in Aachen, Uden and The Hague. More information can be found on <https://www.compumatica.com>.

- Optiver – www.optiver.com

Optiver is a leading trading company where teams of Traders, Researchers and Developers work together to create the most advanced software to set fair prices for investors worldwide. Or as we like to call

it: Market Making. We are always on the lookout for motivated PhD students with an analytical mindset, a flair for numbers and competitive spirit who are eager to help us solve the ever-changing challenges faced when making markets. For anyone with a scientific mind and innate curiosity, this is a hugely rewarding process. Why not use the unique opportunity to meet Optiver.

– Signify – www.signify.com

Signify is the new company name of Philips Lighting. We are the world leader in lighting and provide our customers with high-quality, energy-efficient lighting products, systems and services. We turn light sources into points of data to connect more devices, places and people through light, contributing to a safer, more productive and smarter world.

– Sioux LIME – www.siouxlime.nl

Do you know where FFTs and ML-estimators are used to improve processes and products? Find out how and where we apply our mathware services during the speeddates or visit our website www.siouxlime.nl.

– VORtech – www.vortech.nl

VORtech provides software engineering services for major computational codes. The applications that we work on are typically developed in R&D departments of large companies and used for simulation, prediction and analysis. If you share our interest in mathematics, computational science and data science, please come and meet us.

EWM-NL Session

Tuesday, April 23, 18:20–19:00

Lecture hall Z 80

Coordinator: Olfa Jaibi (Treasurer of EWM-NL, Leiden University)

This session consists of

- a brief presentation of the EWM-NL activities in 2018 and of the EWM network by Maria Vlasiou (president of EWM-NL, TU Eindhoven).
- an exchange of experiences and advice on career paths by panelists Barbara Gentz, Anke van Zuylen, and Svetlana Dubinkina.

About EWM-NL

European Women in Mathematics – The Netherlands (EWM-NL) is a platform for all female professional mathematicians working in the Netherlands and forms the Dutch branch of EWM. EWM-NL organises activities for women in mathematics. These activities are aimed at the EWM-NL missions:

- Forge connections between female mathematicians.
- Support female mathematicians in their career.
- Encourage women to study mathematics.
- Increase the visibility of female mathematicians.
- Provide information about women in mathematics.
- Cooperate with organisations with similar goals.
- Provide a meeting place for people supporting this mission.

Visit www.EWMnetherlands.nl to register to our newsletter and become a member. Membership is open to persons of any gender with interests in the mathematical sciences and is free for all people (formerly) associated with a Dutch higher education institution.

Evening Programme

Tuesday, April 23, 21:30–22:30

Brabant hall

Lecture performance on the ‘spurs’ of Lehmer

by Tom Verhoeff, Roos van Berkel, Marion Tränkle, Ivo Bol, and dancers of the Modern Theatre Dance.

Mathematician Tom Verhoeff and choreographer Roos van Berkel present a lecture performance on the ‘spurs’ of Lehmer, that appear on paths in permutation graphs. They translate these spurs into movement, image and sound. By using the characteristics proximity and minimal change, they present an exact and playful combination of mathematics and dance.

This performance, first given in Veldhoven February 2019, was made possible by the Amsterdam Fund for the Arts, Nationale Wiskunde Dagen, Platform Wiskunde Nederland and the Amsterdam University of the Arts.

Short Biography

Tom Verhoeff is assistant professor at the TU Eindhoven, with research interests in domain-specific languages and in combinatorics. Additionally, he contributes to talent development by teaching enrichment classes, and he volunteers for the Dutch Mathematical Olympiad, Dutch Informatics Olympiad, and the Kangaroo contest. Inspired by (the mathematical sculptures of) his father Koos Verhoeff, he got involved in the analysis and design of mathematical art.

Roos van Berkel choreographs movement for the human and non-human body in systematic and ludic ways. Her work has been shown at various digital art and art & technology festivals in The Netherlands: E-Pulse, STRP and Discovery festival. Other festivals include Ghent Light Festival, Museumnacht Amsterdam and different theatre festivals in Hungary and Romania. For the past ten years, Van Berkel has taught at the Amsterdam University of the Arts and the TU Eindhoven. In July 2018, she received a development grant from the Amsterdam Fund for the Arts to enrich her work on performance and technology with specific scientific themes.

Strategy Session

Wednesday, April 24, 10:00–11:00

Brabant hall

Chair: Sjoerd Verduyn Lunel (chairman of PWN)

In the session, several aspects will be discussed:

- The recent “Sectorplan Beta en Techniek”, leading to many new positions at all mathematics institutes in The Netherlands, as well as to significant resources for outreach and education of teachers. Frank van der Duyn Schouten will also discuss the work of the Wiskunderaad.
(20 minutes)
- Presentation of the report of the evaluation of the Mathematics Clusters by Robert Tijdeman, and first reactions by representatives of NWO.
(30 minutes)
- Some aspects of innovation by Vivi Rottschäfer: the PWN Committee for Innovation, Study Group Mathematics with Industry, funding opportunities.
(10 minutes)

Abstracts

Plenary Lectures

Tuesday, April 23

Jan S. Hesthaven (EPFL)

10:45-11:45

Structure preserving reduced order models.

The development of reduced order models for complex applications has the promise for rapid and accurate evaluation of the output of complex models under parameterized variation with applications in problems which require many evaluations, such as in optimization, control, uncertainty quantification and applications where near real-time response is needed. However, many challenges remain to secure the flexibility, robustness, and efficiency needed for general large scale applications, in particular for nonlinear and/or time-dependent problems.

In this talk we discuss the development of reduced methods which seek to conserve chosen invariants for nonlinear time-dependent problems. In the first part, we develop structure-preserving reduced basis methods for a broad class of Hamiltonian dynamical systems, endowed with a general Poisson manifold structure which encodes the physical properties, symmetries and conservation laws of the dynamics.

In the second part, we focus on reduced order modeling of more general hyperbolic problems, discuss the importance of the skew-symmetric form of the governing equations, and the benefits of using the skew-symmetric form for the reduced order model. We demonstrate the methods through the numerical simulation of various fluid flows.

Dion Gijswijt (TU Delft)

15:30-16:45

Cap sets and new applications of the polynomial method.

In a beautiful paper (March 2002 issue of ‘Het Nieuw Archief voor Wiskunde’), N.G. de Bruijn explains that the popular card game SET is actually finite geometry in disguise. The cards correspond to points in a four-dimensional space over a field of three elements and the ‘SETs’ are lines in this space. Geometrically, the players are looking for lines contained in subsets of points.

A collections of cards (more generally: a subset of $GF(p)^n$) with no three point of a line is called a ‘cap’ or ‘cap set’. Studying the size and structure of caps is one of the main problems in finite geometry. The ‘cap set problem’ is concerned with the maximum size of cap sets as the dimension of the space increases. The central question (raised by Frankl, Graham and Rödl in 1986) is: “Do cap sets have exponentially small density?”

In 2016, the ‘cap set problem’ was (very unexpectedly) resolved using the polynomial method. The proof is surprisingly short and simple. In this talk, I will explain the main ideas of the proof and discuss generalisations and connections to closely related problems such as ‘fast matrix multiplication’.

Barbara Gentz (University of Bielefeld)

17:00-18:00

Noise in coupled dynamics—friend or foe?

How does our heart beat remain so regular for so long? How does an ensemble of metronomes on a platform spontaneously synchronise? This odd kind of sympathy was first reported in 1665 by Christiaan Huygens in a letter to Sir Robert Moray.

Actually, synchronisation is ubiquitous in nature. It can be externally forced or spontaneous. Radio-controlled clocks, artificial cardiac pacemakers and circadian rhythms are examples of externally forced synchronisation. Besides Huygens pendulum clocks, our natural cardiac pacemaker and the swaying of the Millennium Bridge in London are examples of spontaneous synchronisation.

In this talk, simple mathematical models for synchronisation will be presented. It will be argued why random influences, so-called noise, should be taken into account. Quantifying its effect will then allow to decide whether the noise is actually friend or foe.

Wednesday, April 24

Anke van Zuylen (College of William & Mary)

9:00-10:00

Improved tours and paths for the traveling salesman: Classical tools and recent advances.

The traveling salesman problem (TSP) is one of the most famous and widely studied combinatorial optimization problems. Given a set of cities and pairwise distances, the goal is to find a tour of minimum length that visits every city exactly once. Even if we require the distances to form a metric, the problem remains NP-hard. The classic Christofides's algorithm finds a tour that has length at most $3/2$ times the length of the optimal tour. Despite significant effort, no efficient algorithm has been found in over 40 years that improves on the approximation guarantee of $3/2$ achieved by Christofides's algorithm. A well-known, natural direction for making progress which has also defied improvement is the use of a linear programming (LP) relaxation. The famous "four-thirds" conjecture states that there always exists a tour of at most $4/3$ times the length of the optimal value of the so-called subtour LP relaxation for the TSP.

Although this conjecture has been open for decades, recent years have seen some exciting progress toward resolving the conjecture, including improved algorithms for approximating the optimal value for several variants such as the graph-TSP (where the input metric is the shortest path metric on an unweighted graph) and the s-t path TSP (where the start and end of the tour are distinct). In this talk, we provide a tour of the recent advances for the metric TSP and in particular the s-t path TSP. We will highlight some of the new techniques that have been developed, building on classical results in polyhedral combinatorics and combinatorial optimization on trees, matroids, matchings, T-joins, flows and shortest paths.

Gábor Lugosi (Universitat Pompeu Fabra)

16:30-17:30

Many questions and a few answers in network archeology.

Networks are often naturally modeled by random processes in which nodes of the network are added one-by-one, according to some random rule. Uniform and preferential attachment processes are prime examples of such dynamically growing networks. The statistical problems we address in this talk regard discovering the past of the network when a present-day snapshot is observed. Such problems are sometimes termed "network archaeology". We present a few results that show that, even in gigantic networks, a lot of information is preserved from the very early days. As the field is still in its infancy, many interesting questions remain to be explored.

KWG-PhD Prize and Stieltjes Prizes

Tuesday, April 23, 14:00-16:00

Brabant hall

In this session there will be three lectures by winners of the Stieltjes Prize and four lectures by candidates for the KWG-PhD Prize. The prize ceremonies will be held at the closing ceremony of the NMC 2019.

Stieltjes Prize

Jorn van der Pol (TU Eindhoven)

14:00-14:20

Large matroids.

A matroid is a set system that abstracts the notion of “independence” in various settings. The original motivating examples were vector spaces (linear independence) and graphs (cycle-freeness), but matroids today have strong ties with areas of mathematics as diverse as graph theory, projective geometry, coding theory, and combinatorial optimisation.

We are interested in the statistical properties of a “random” matroid. This is useful, for example, for understanding the expected behaviour of algorithms that take a matroid as input.

The problems start when we consider matroids on a large number of points. The number of matroids grows incredibly fast with the number of points—so fast in fact, that even for sets of 15 points it is infeasible to generate a database of all matroids, let alone obtain statistics on such a database.

We have developed more clever tools to analyse large random matroids.

Souvik Dhara (TU Eindhoven)

14:20-14:40

Critical percolation on random networks with prescribed degrees.

Random graphs play an instrumental role in modelling real-world networks such as those arising from the internet topology and social networks. Percolation, on the other hand, has been the fundamental model for understanding robustness and spread of epidemics on these networks. From a mathematical perspective, percolation is the simplest model that exhibits phase transition, and fascinating features are observed around its critical point. For percolation on complete graphs, Aldous (1997) derived a groundbreaking result characterizing the scaling limits for the sizes of the connected components at criticality, when the network size grows large. Subsequently, there has been a surge of activity to understand the critical behaviour under more general settings. Conjectures from physics state that the behaviour of functionals like the component size, diameter, are not guided by microscopic connectivity structure of the networks, but network statistics such as the degree distribution.

In this talk, we consider percolation on random graphs with prescribed degrees, and describe how three fundamentally different types of critical behaviour can emerge depending on the moments of the asymptotic degree distribution, with the scaling limit derived by Aldous being one of them.

This talk is based on joint works with Shankar Bhamidi, Remco van der Hofstad, Johan van Leeuwaarden, and Sanchayan Sen.

Joost Nuiten (Utrecht University)

14:40-15:00

Deformation problems in derived geometry.

Given an algebro-geometric object, such as a ring, a vector bundle or a variety, deformation theory studies infinitesimal families of objects around it. It turns out that over a field of characteristic zero, these infinitesimal families can often be classified explicitly in terms of Lie algebras. This fact first arose in the work of Kodaira and Spencer on deformations of complex manifolds, and has been given a prominent role in work of Deligne and Drinfeld. Recent results by Lurie and Pridham explain this phenomenon in terms of derived geometry: most algebro-geometric objects can be organized into (derived) moduli spaces and the formal neighbourhood of a point in such a moduli space is completely determined by its tangent space, endowed with a Lie bracket.

In this talk, I will discuss a variant of this result, giving a Lie algebraic description of the formal neighbourhood of subvariety inside a moduli space, instead of a single point. This can also be used to study formal deformations of the moduli space itself, possibly into a non-commutative object.

KWG-PhD Prize

Peter Koymans (Leiden University)

15:00-15:15

Factoring in number fields.

The fundamental theorem of arithmetic states that every positive integer can uniquely be factored as a product of primes. Nowadays, factoring plays an important role in many fields of mathematics ranging from number theory to cryptography. In this talk we study factorization properties of other rings than the integers. Factorizations may no longer be unique in this new setting. We then introduce the class group, which measures the failure of unique factorization, and discuss its statistical properties.

Nicos Starreveld (University of Amsterdam)

15:15-15:30

Breaking of ensemble equivalence in complex networks.

In random graph theory researchers often rely on machinery and concepts from statistical physics and interacting particle systems. A widely applied

method uses mathematical models that have maximal entropy given the observed information. A (crucial) subtlety in this respect is that one should distinguish between the case in which the network information is ‘exact’ (i.e. covers detailed information on individual network components) or ‘on average’ (i.e. describes average properties of the underlying network). We obtain thus two mathematical models, viz. the microcanonical ensemble corresponding to ‘exact observations’ and the canonical ensemble corresponding to ‘average observations’. Traditionally, it was generally believed among physicists that both ensembles are equivalent (which we call ensemble equivalence).

Importantly, it was recently shown that one can construct examples in which there is no equivalence. In my work I made substantial progress in understanding under what conditions ensemble equivalence breaks. For the situation that the measurements correspond to the total number of edges in combination with the total number of triangles, I have developed an in-depth assessment of ensemble equivalence. Informally, I have proven the result that if the number of edges is somehow ‘misaligned’ with the number of triangles, there is breaking of ensemble equivalence. In addition, for a small perturbation around the typical values I have succeeded in computing the entropy of both ensembles, and have shown that they correspond to drastically different network structures. Specifically, my results show that decreasing the number of triangles in a network, while keeping the total number of edges fixed, is much more costly than increasing it.

Pavel Solomatín (Leiden University)

15:30-15:45

Invariants of global fields: From Artin L -functions towards anabelian geometry.

Let K be a global field i.e. either a number field or global function field. These fields play the crucial role in every branch of modern mathematics from abstract algebra and number theory to applied cryptography and information theory. In order to study different properties of K one attaches to it a list of different invariants. Some invariants such as degree, discriminant, regulator or Dedekind ζ -function $\zeta_K(s)$ can be represented as numerical data. Meanwhile other invariants like normal closure, group of units, ideal class-group or the absolute Galois group $\mathcal{G}_K = \text{Gal}(K^{\text{sep}}/K)$ represent more sophisticated data attached to K .

Of course, one of the basic questions is to understand how much information about K one can recover from those invariants mentioned above. For instance, an interesting problem could be stated as follows, “*when does the Dedekind zeta-function $\zeta_K(s)$ recover the isomorphism class of K ?*”. This is known to be true, for example for normal extensions of $\mathbb{Q}$, but in general this is not the case and the answer is given by a beautiful group theoretical construction known as *Gassmann triples*. This problem is often called the *isospectral problem for number fields*, since it has strict parallel with the differential ge-

ometry phenomena known as isospectral manifolds. It turns out that $\zeta_K(s)$ determines a lot of other invariants of K for example degree, discriminant, group of units, normal closure and in some sense *almost determines* regulator, ideal class-group. Meanwhile the famous Neukirch–Uchida Theorem states that the isomorphism class of K is determined by the isomorphism class of $\mathcal{G}_K$, so $\zeta_K(s)$ allows us to know a lot about K , but not everything. Note that originally Neukirch proved this result for the case of normal extensions by recovering $\zeta_K(s)$ from $\mathcal{G}_K$. After that Uchida extended it to the case of all global fields, but he used a different and more sophisticated technique.

We will explain what kind of numerical information one can add to $\zeta_K(s)$ such that this data will determine the isomorphism class of K . This numerical information is encoded in the so-called Artin L-functions of Galois representations of K .

Rik Versendaal (TU Delft)

15:45–16:00

Large deviations for random walks in Riemannian manifolds

Large deviations is the area where one quantifies the exponentially small probabilities of deviations on the scale of the Law of Large Numbers. It finds its applications in (among others) statistical physics and stochastic control.

For random walks and diffusions, large deviation properties have mostly been studied in a vector space context. We initiate the study of large deviations in a geometric setting such as Riemannian manifolds. This is motivated for example by nanobiology, where one wants to understand the (random) movement of proteins through a cell-membrane. Because of the small scale, it is necessary to take into account the curvature of the cell-membrane. Additionally, it is also motivated by more applied fields such as geometric data analysis and computer vision.

The aim of this talk is to introduce a first result in this direction, namely a generalization of Cramér’s theorem on large deviations for a sequence of rescaled random walks. Following Erik Jørgensen’s work, “The central limit problem for geodesic random walks,” published in 1975, we introduce the generalization of the concept of a random walk to Riemannian manifolds, so called *geodesic random walks*. Using this, we explain the statement of the generalization of Cramér’s theorem to Riemannian manifolds and compare this result to the Euclidean setting.

Parallel Sessions

DIAMANT–GQT: Arithmetic and Geometry

Tuesday, April 23, 13:30-15:00

Lecture hall Z 80

Organizers: David Holmes (Leiden University)

Martijn Kool (Utrecht University)

Chris Lazda (University of Amsterdam)

13:30-14:10

Zeta functions, Weil–Deligne representations and l -independence for local fields.

Any scheme of finite type over $\mathbb{Z}$ has a well-defined zeta function; for example, the zeta function of $\mathbb{Z}$ itself is the famous Riemann zeta function, but the theory also encompasses zeta functions of curves over finite fields, and much more exotic objects. In all these cases, all the local factors of the zeta function have a beautiful cohomological interpretation. Starting with such a scheme over $\mathbb{Q}$, however, it is not a priori clear how to define its zeta function, since different models over $\mathbb{Z}$ can and do have different zeta functions. One way around this is to use the cohomological interpretation of the local factors as a definition, but to ensure that this makes sense, one needs to know l -independence results for the cohomology of varieties over local fields. In my talk I will explain how to formulate these independence results in a very precise manner using the theory of Weil–Deligne representations, and explain a little bit how to prove them for smooth and proper varieties over local function fields.

Francesca Balestrieri (MPI Bonn)

14:20-15:00

Arithmetic of zero-cycles on products of Kummer varieties and K3 surfaces.

The following is joint work with Rachel Newton. In the spirit of work by Yongqi Liang, we relate the arithmetic of rational points to that of zero-cycles for the class of Kummer varieties over number fields. In particular, if X is any Kummer variety over a number field k , we show that if the Brauer–Manin obstruction is the only obstruction to the existence of rational points on X over all finite extensions of k , then the Brauer–Manin obstruction is the only obstruction to the existence of a zero-cycle of any odd degree on X . Building on this result and on some other recent results by Ieronymou, Skorobogatov and Zarhin, we further prove a similar Liang-type result for products of Kummer varieties and K3 surfaces over k .

NDNS+–STAR: Numerics meets Statistics

Tuesday, April 23, 13:30-15:00

Lecture hall Z 81

Organizers: Marie-Colette van Lieshout (CWI)

Kathrin Smetana (University of Twente)

Rob Scheichl (Heidelberg University)

13:30-14:15

Uncertainty Quantification: When numerics meets statistics.

Numerical methods for partial differential equations (PDEs) and their implementations on high performance computers have reached a level of sophistication that allows the numerical simulation of ever more complex, heterogeneous, nonlinear processes. Many openly available PDE software packages exist. However, model parameters and initial/boundary conditions are typically only partially available or measurable and those measurements are often indirect and/or noisy. On the other hand, statistical methods for inverse problems that allow to infer distributions of unknown or uncertain parameters given (noisy) measurements of the system have also reached a high level of sophistication, in particular Bayesian techniques such as the gold-standard Metropolis–Hastings MCMC or filtering techniques. Nevertheless, the application of Bayesian inference to complex PDE constrained inverse problems is still a hugely challenging task. This is partly due to their high computational complexity, but also to the typically very high dimensional parameter domain. To overcome these challenges requires a concerted effort of statisticians, numerical analysts and application scientists, which has spawned the new scientific research area of Uncertainty Quantification (UQ). In this talk, I will present a number of examples from my research where classical ideas from numerical analysis and scientific computing are used to increase the efficiency of Bayesian statistical methods for PDE problems. In particular, I will highlight hierarchical approaches such as multilevel Monte Carlo as well as low-rank matrix and tensor approximations to accelerate sampling methods.

Finn Lindgren (The University of Edinburgh)

14:15-14:35

Modelling and computation for multiscale spatio-temporal temperature reconstruction.

Combining multiple and large data sources of historical temperatures into unified spatio-temporal analyses is challenging from both modelling and computational points of view. As part of the H2020 EUSTACE project, new approaches needed to be developed not only due to the size of the problem, but also due to the highly heterogeneous data coverage and the latent heterogeneous physical processes. A specific aim was to design a system that could obtain realistic uncertainty estimates, due to both observation uncertainty and lack of spatio-temporal coverage.

To this end, a spatio-temporal multiscale statistical Gaussian random field model is constructed, with a hierarchy of spatially non-stationary spatio-temporal dependence structures, ranging from weather on a daily timescale to climate on a multidecadal timescale. Connections between SPDEs and Markov random fields are used to obtain sparse matrices for the practical computations. The extreme size of the problem necessitates the use of iterative solvers, which requires using the multiscale structure of the model to design an effective preconditioner.

Svetlana Dubinkina (CWI)

14:40-15:00

Bayesian approach to elliptic inverse problems.

Predicting the amount of gas or oil extracted from a subsurface reservoir depends on the soil properties such as porosity and permeability. These properties, however, are highly uncertain due to the lack of measurements. Therefore decreasing these uncertainties is of a great importance.

Mathematically speaking, permeability can be represented by a random process, which in turn leads to a random partial differential equation. The solution of such a partial differential equation, for example pressure, is only partially observed and, moreover, contaminated with measurement errors. Therefore, instead of a well-posed forward problem of finding pressure from certain permeability, we are faced with an ill-posed inverse problem of finding an uncertain random process from a few pressure measurements. We develop a Bayesian method for inverse problems, that is both general and computationally affordable.

4TU.AMI: Mathematical Aspects of Machine Learning

Tuesday, April 23, 13:30-15:00

Lecture hall Z 82

Organizers: Barry Koren (TU Eindhoven)
Wil Schilders (TU Eindhoven)

Anastasia Borovykh (CWI)

13:30-14:00

Understanding generalisation in noisy time series forecasting.

In this presentation we study the loss surface of neural networks for noisy time series forecasting. In extrapolation problems for noisy time series, neural networks, due to overparametrization, tend to overfit and the behavior of the model on the training data does not measure accurately the behaviour on unseen data due to e.g. changing underlying factors in the time series. Avoiding overfitting and finding a pattern in the data that persists for a longer period of time can thus be very challenging. In this talk we quantify what the neural network has learned using the structure of the loss surface of multi-layer neural networks. We discuss how to use the learning algorithm to control the trade-off between the complexity of the learned function and the ability of the function to fit the data. Furthermore, we gain insight into which minima are able to generalise well based on the spectrum of the Hessian matrix and the smoothness of the learned function with respect to the input.

Jim Portegies (TU Eindhoven)

14:00-14:30

Can Variational Autoencoders capture topological properties?

Although Variational Autoencoders (VAE) are often used to identify latent variables underlying certain datasets, there are many open questions about their performance.

We have investigated a particular question, namely in how far a VAE can capture topological and geometrical properties of datasets. Since there are obstructions hindering a standard VAE in capturing these properties, we designed an algorithm, the Diffusion VAE, to remove these obstructions for particular datasets by allowing for an arbitrary manifold as latent space. This is joint work with Luis Prez and Vlado Menkovski.

Christoph Brune (University of Twente)

14:30-15:00

Deep Inversion—Autoencoders for learned regularization of inverse problems.

This talk will highlight how deep learning, inverse problems theory and the calculus of variations can profit from each other. Data-driven deep learning methods have revolutionized many application fields in imaging and data science. Recently, first classical methods from the calculus of variations and inverse problems have been combined with deep learning to effectively estimate hidden parameters. Such variational networks with learned regularization and unrolled gradient flow optimization have enabled deep convolutional

neural networks (CNN) to tackle inversion tasks with strongly improved performance.

However, even in the context of very basic CNN inversion methods, one fundamental aspect of inverse problems theory is still largely missing: understandable regularization scales addressing ill-posedness, i.e. stability properties of the learned inversion process. In machine learning theory this is often referred to as adversarial attacks. In this talk, we present a latent space analysis of autoencoding networks to learn the regularization of inverse problems in a controlled way. This offers new mathematical tools and insights for addressing the above limitation.

Basic deconvolution problems and realistic inversion in photoacoustic tomography illustrate the gain of deep autoencoding networks in inverse problems.

DIAMANT–STAR: Stochastics meets Optimization

Wednesday, April 24, 11:30-13:00

Lecture hall Z 80

Organizers: Onno Boxma (TU Eindhoven)

Frits Spieksma (TU Eindhoven)

Ward Romeijnders (University of Groningen)

11:30-12:15

Convex approximations for mixed-integer stochastic programs.

We consider two-stage mixed-integer stochastic programs. These optimization problems are notoriously difficult to solve since they combine the difficulties of having random parameters and integer decision variables in linear programming problems. For this reason, we do not aim to solve these problems exactly, but instead construct convex approximations for these problems. To guarantee the performance of the resulting approximating solutions, we derive error bounds for the convex approximations. The error bounds are smaller if the variability of the random parameters in the model is larger.

Stella Kapodistria (TU Eindhoven)

12:15-13:00

Exact and approximate solutions for a class of stochastic dynamic programming problems.

We consider a class of stochastic dynamic programming (SDP) problems arising in the context of maintenance. Such SDP problems aim at deriving optimal policies (when should maintenance be performed and by how much should the system be maintained). From a fundamental perspective, the difficulty of such SDP problems lies in deriving the optimal policy. From a numerical perspective, the difficulty lies in computing the policy (the curse of dimensionality). While, from a practical perspective, the difficulty lies in the stochastic modelling of all the relevant information (big data). In this talk, we present an overarching framework that aims at addressing all aforementioned challenges.

GQT–NDNS+: Geometry and Dynamics

Wednesday, April 24, 11:30-13:00

Lecture hall Z 81

Organizers: Ioan Marcu (Radboud University)

Oliver Fabert (Vrije Universiteit Amsterdam)

Marco Zambon (KU Leuven)

11:30-12:15

Foliations, regular and singular.

A regular foliation gives a partition of a space (manifold) into smooth subspaces (leaves), all of which have the same dimension. A regular foliation carries a rich geometry structure: for instance, as I will discuss, it comes with a certain dynamics, which can be used to provide a normal form nearby a given leaf and also to attach a group-like structure (a Lie groupoid) to the regular foliation. If one allows the leaves to vary dimension, it turns out that it is a good idea to prescribe vector fields (necessarily with singularities) giving rise to the partition. One then obtains a rich geometry, and results analogous to those of the regular case.

Fabian Ziltener (Utrecht University)

12:15-13:00

Hamiltonian Lie group actions: examples and a classification result.

Symplectic geometry originated from classical mechanics. Hamiltonian Lie group actions correspond to symmetries in mechanics. They can be used to reduce the number of degrees of freedom of a mechanical system. I will discuss some examples of such actions and present some joint work with Yael Karshon, in which we classify Hamiltonian actions of compact Lie groups on exact symplectic manifolds with proper momentum maps.

History of Differential Geometry

Wednesday, April 24, 11:30-13:00

Lecture hall Z 22

Organizer: Gerard Alberts (University of Amsterdam)

Raf Bocklandt (University of Amsterdam)

11:30-11:55

Italian connections.

We investigate how Riemann's love for Italy influenced whole generations of Italian geometers. We will focus on two specific examples: Betti and the idea of connectedness and Ricci–Curbastro and Levi–Civita and the idea of a connection.

Tilman Sauer (University of Mainz)

11:55-12:20

Modelling parallel transport.

In 1918, the Dutch geometer Jan Arnoldus Schouten used plaster models of standard curved surfaces to illustrate a novel geometric concept of geodesic transport of reference frames in curved spaces. The paper discusses Schouten's use of material modelling in the context of an emerging abstract geometric concept of parallel transport.

Alberto Cogliati (Università degli Studi di Milano)

12:20-12:45

Cartan and Schouten: the search for connection.

I will provide an analysis, both historical and mathematical, of two joint papers on the theory of connections by Élie Cartan and Jan Arnoldus Schouten that were published in 1926. These papers were the result of a fertile collaboration between the two eminent geometers that flourished in the two-year period 1925-1926. I will describe the birth and the development of their scientific relationship especially in the light of their correspondence that, on the one hand, offers valuable insight into their common research interests and, on the other hand, provides a vivid picture of Cartans and Schoutens different technical choices.

Gerard Alberts (University of Amsterdam)

12:25-13:00

Brief remark on the Schouten archive.

The archive of J.A. Schouten (1883-1971), with its thousands of letters, offers a uniquely close view on the practice of mathematics over a period five decades. It inspires research into the history of differential geometry in particular and the changing practice of mathematics in general.

NETWORKS

Wednesday, April 24, 11:30-13:00

Lecture hall Z 82

Organizer: Michel Mandjes (University of Amsterdam)

Julia Komjathy (TU Eindhoven)

11:30-12:00

Explosive information diffusion on scale-free spatial random graphs.

In the talk we study weighted distances in scale-free spatial network models, so called geometric inhomogeneous random graphs (GIRG). In this model, each vertex is given an independent weight and location from the unit cube (or torus) in d dimensions, respectively, and two vertices are connected independently with a probability that is a function of their distance and weights. We assign i.i.d. weights to the edges of the created random graphs and study the weighted distance between two uniformly chosen vertices. The question is, how does the weight of the minimal weight path scale as the number of vertices tends to infinity? This length corresponds to the transmission time of the information between a source vertex and another vertex.

We give an if and only if condition on the edge-weights for the following phenomenon that is often called explosion: the time it takes to transfer the information does not grow with the size of the graph, but rather converges in distribution.

This model—despite its simplicity—can explain why for instance trendy videos on the internet can reach a large proportion of the world's population in a short amount of time.

Tobias Müller (Groningen University)

12:00-12:30

Percolation and random graphs in the hyperbolic plane.

In my talk, I will describe some recent and ongoing work on random geometric graphs and Poisson–Voronoi percolation in the hyperbolic plane.

Random geometric graphs are obtained by taking a random set of points in the plane (usually either generated by a Poisson process or sampled i.i.d. uniformly from a large disk or square), and then joining any pair of points by an edge whose distance is less than some parameter r_0 . In the Poisson–Voronoi percolation model, we take a constant intensity Poisson process and assign to each point its Voronoi-cell, that is the set of all points closer to it than to any other Poisson point, and then we flip a coin for each cell to determine whether it will be coloured black or white. We say that percolation occurs if the set of black cells contains an unbounded component.

For both these models it turns out that the hyperbolic versions display behaviour that is spectacularly different from their Euclidean counterparts.

(Based on recent and ongoing works with M. Bode, E. Broman, N. Fountoulakis, B. Hansen, P. van der Hoorn, D. Mitsche, J. Tykesson, M. Schepers.)

On approximating the covering radius and finding dense lattice subspaces.

Kannan & Lovasz (Annals of Math ‘88) asked whether the covering radius of an n -dimensional Euclidean lattice can be tightly characterized using only volumetric information, namely using only determinants of lattice projections. In a recent breakthrough, Regev and Stephens–Davidowitz (STOC ‘17) answered this question in the affirmative, showing that the determinant of the “sparsest” lattice projection can in fact certify a lower bound on the covering radius that is tight up to polylogarithmic factors in the lattice dimension n . In this work, we first refine this characterization, by showing that using a chain of lattice projections one can in fact certify a lower bound that is tight up to the so-called slicing constant of Voronoi cells, which is conjectured to be $O(1)$. Second, we make this theory algorithmic by providing a single exponential time algorithm based on discrete Gaussian sampling for computing an $O(\log^{2.5} n)$ -approximately sparsest lattice projection. For this purpose, we rely heavily upon on the notion of canonical filtration of a lattice, developed by Stuhler in ‘76 and a reverse Minkowski theorem of Regev and Stephens–Davidowitz.

Quantum Software Consortium

Wednesday, April 24, 11:30-13:00

Lecture hall Z 83

Organizer: Ronald de Wolf

(QuSoft, CWI and University of Amsterdam)

Barbara Terhal

11.30-12.00

(QuTech, TU Delft and Forschungszentrum Jülich)

Quantum phase estimation and its applications.

We review the circuit model of quantum computation with which quantum algorithms are formulated. At the core of many quantum algorithms, including the factoring algorithm and algorithms for physics and chemistry problems, lies the subroutine of quantum phase estimation. We discuss what problem quantum phase estimation solves and how it does this. We review some of the variants of phase estimation and show how phase estimation can be simplified in some cases. Such simplification can be viewed as a form of hybrid quantum-classical computation, leading to a saving of quantum resources.

Arjan Cornelissen (QuSoft and CWI)

12.00-12.30

Quantum gradient estimation.

Estimating the gradient of a real-valued function is used as a building block in many classical algorithms. Frequently, the objective functions whose gradients are to be estimated are not differentiable in closed form analytically, and hence the estimate of the gradient is usually based on evaluations of the function around the point at which the gradient is to be evaluated. In the classical case, the number of function evaluations necessary to estimate a d -dimensional gradient is easily seen to be at least $d + 1$. Gilyen et al. investigated whether this number of function evaluations can be reduced using a quantum algorithm. It turns out that under some smoothness condition, the number of function evaluations can be reduced to $O(\sqrt{d})$, and I proved this method to be optimal even under a somewhat stronger smoothness condition. This algorithm could lead to algorithmic speed-ups, especially in applications where the domain of the function is high-dimensional, as often happens in machine learning.

Vedran Dunjko (Leiden University)

12.30-13.00

Quantum computational speed-ups with small quantum computers.

Theory shows that arbitrary-sized quantum computers may offer computational advantages for many problems. However, quantum computers we are likely to have in the foreseeable future will be restricted in many ways, including size. Motivated by this, we investigate whether a small quantum computer (limited to M qubits) can genuinely speed up interesting algorithms,

even when the problem size is much larger than the computer itself. We show that this is possible. We present a specific hybrid quantum-classical algorithm to solve 3SAT problems involving $n \gg M$ variables, that significantly speeds up its fully classical counterpart. Finally, we provide a more abstract characterization of the criteria which allow such speed-ups with smaller quantum computers, and discuss the broader applicability of our approach.

Docentendag

Wednesday, April 24, 14:00-16:00

Lecture hall Z 80

Organizer: Swier Garst (NVvW)
Wim Caspers (TU Delft)

Jeanine Daems (Hogeschool Utrecht)

14:00-14:45

Creatief met kegelsneden.

Kegelsneden zijn leuke wiskundige objecten omdat je er op zoveel manieren naar kunt kijken: je kunt ze zien als de doorsneden van een kegel, als conflictlijnen tussen punten en lijnen of cirkels, of je kunt ze analytisch benaderen. Je kunt kegelsneden vouwen, je kunt een parabool gebruiken als rekenmachine voor vermenigvuldigingen. Frans van Schooten ontwierp mechanische apparaten om kegelsneden mee te kunnen tekenen en Omar Khayyam gebruikte kegelsneden om derdegraads vergelijkingen meetkundig op te lossen. In deze lezing gaan we een aantal van die aspecten van kegelsneden wat nader bekijken.

Commissie Onderwijs PWN

14:45-15:15

Over de beroepsstandaard van de docent wiskunde en over de aansluiting voortgezet en hoger onderwijs.

Aan het woord komen onder andere Jan Karel Lenstra, Theo van de Boogaart en Wim Caspers van de Commissie Onderwijs van PWN. De commissie rapporteert over twee van haar activiteiten.

- PWN is bezig een beroepsstandaard te ontwikkelen. Deze sluit aan bij de wettelijke bekwaamheidseisen van de Onderwijscoöperatie, maar zal een specificatie zijn voor het beroep van leraar wiskunde. Een beroepsstandaard geeft een duidelijke profilering aan het beroep van wiskundeleraren. In het verleden is een aantal keer gebleken dat hier behoefte aan is: bijvoorbeeld bij de ontwikkelingen rondom het lerarenregister of in de totstandkoming van kennisbases (vak en vakdidactiek) voor hbo-lerarenopleidingen. Ook zou een beroepsstandaard van pas kunnen komen in de politieke discussie over het bevoegdheidstelsel; denk daarbij ook aan de invoering van de educatieve minor, de bevoegdheid groepsleerkracht (PABO-plus) of het recente advies van de Onderwijsraad. De stand van zaken wordt toegelicht.
- In januari 2018 schreef de Commissie Onderwijs samen met de Nederlandse Vereniging van Wiskundeleraren ten behoeve van curriculum. Nu een notitie waarin een visie op de toekomst van het curriculum wiskunde in het voortgezet onderwijs werd gegeven. Onderdeel ervan was een voorstel tot hervorming van de bovenbouw van HAVO en VWO

op aansluiting met HBO en universiteit te verbeteren. De commissie is bezig om dat voorstel bij diverse opleidingen in den lande voor te leggen, opleidingen waar een groot beroep op wiskundevoorkennis wordt gedaan. De bevindingen tot nu toe worden gepresenteerd.

Derk Pik (Pythagoras, University of Amsterdam)

15:15-16:00

Finale van de Pythagoras Profielwerkstukwedstijd.

Dit jaar organiseert Pythagoras voor de vierde keer de profielwerkstukwedstijd voor wiskundige profielwerkstukken. Middelbare schoolleerlingen schrijven in de laatste twee jaren van hun schoolcarrière een profielwerkstuk, dat ook over wiskunde mag gaan. Voor deze scholieren heeft Pythagoras de wiskunde-profielwerkstukprijs in het leven geroepen.

Uit ingezonden profielwerkstukken selecteert een jury van universitaire wiskundigen maximaal drie exemplaren. De auteurs van deze profielwerkstukken houden op het Nederlands Mathematisch Congres een presentatie van tien minuten, waarna de publieksprijs door een stemming wordt bepaald.

Voorgaande jaren waren er winnende profielwerkstukken over de QR-code, de Riemannhypothese, een zelfontworpen cryptografisch algoritme en het zo goed mogelijk plaatsen van n brandstofstations op de maan.

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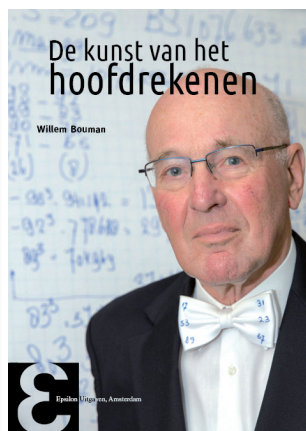
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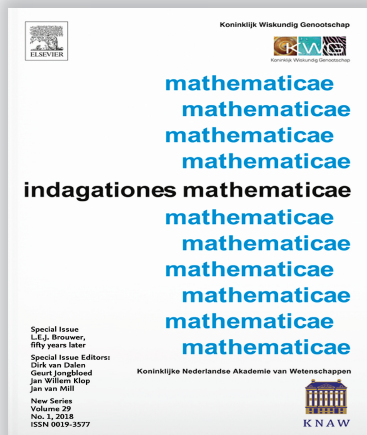
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