Doctoral Program Discrete Mathematics

Univ.-Prof. Dr. W. Woess
Speaker

Univ.-Prof. Dr. A. Geroldinger
Univ.-Prof. Dr. J. Thuswaldner
Deputy Speakers

Dr. D. Kreso
Coordinator

Steyrergasse 30/III
A-8010 Graz
Austria

Tel. +43(0)316 873-7132
Fax +43(0)316 873-4507

discrete@tugraz.at
www.math.tugraz.at/discrete

DK Day 2016

Friday, 4 November 2016

TU Graz, Steyrergasse 30,
Lecture Hall BE01 (ground floor)

Schedule and abstracts

$10:30 - 10:45$ **Opening**
Presentation of the Doctoral Program Discrete Mathematics

$10:45 - 11:35$ **Talk by Prof. Tim Netzer (Universität Innsbruck)**
Title: Checking Inclusion of Polytopes and Spectrahedra

Abstract: The question whether one polytope is contained in another arises in interesting applications. Its computational complexity depends on the type of the input, and reaches from polynomial time to co-NP-hard. Spectrahedra are generalizations of polyhedra, and appear as feasible sets in semidefinite programming. In many applications, one or both of the given sets are spectrahedra, and inclusion testing becomes even more complicated, even at a conceptual level. There are certain relaxations of the problem, that work well in practice. After introducing the necessary background, we show that these relaxations are only reliable for simplices, and we derive some quantitative error bounds in the general case. The results use methods from operator theory, and some nice elementary constructions.

$11:35 - 12:05$ **Talk by Stefan Planitzer (DK-Project 13)**
Title: Romanoff's theorem and related problems

Abstract: In 1934 Romanoff proved that the set of integers of the form $p + g^n$, where p is a prime, $n \in \mathbb{N}$ and $g \geq 2$ a fixed positive integer, has positive lower density. The method of proof developed by Romanoff was subsequently applied to a lot of problems of a similar nature. We will give a short survey of some known classical and more recent results concerning questions of Romanoff type. After discussing the main tools applied by Romanoff in the proof of his theorem we will also present some new results coming from joint work with Manfred Madritsch and ongoing joint work with Christian Elsholtz and Florian Luca.

$12:05-13:30$ **Lunch break** - warm buffet in front of HS BE01 (for all participants!)

$13:30-14:00$ **Talk by Gundelinde Wiegel (DK-Project 01)**
Title: Lyapunov exponents on trees

Abstract: We consider a symmetric nearest neighbour random walk on an infinite regular tree moving in random potential. The potentials represent a random risk of dying for the random walk at each vertex. A measurement for the riskiness of moving in this random medium is provided by the Lyapunov exponents. They observe the long time behaviour of the probability of reaching a certain vertex after starting at a fixed vertex. There are two different ways of treating the random potentials in this observation: the annealed (or averaged) and the quenched approach. We will see that here we can directly relate these two approaches to each other.

$14:00-14:45$ **Ligia Loretta Trio - Learning to Fly**
Ligia Loretta Cristea - vocals, compositions, lyrics
Emmanuel Maze - akkordeon, keys
Thorsten Zimmermann - double bass and electric bass

Jazzy songwriting with a flair of chanson and world music, a multifaceted crossover that transports the listener through different states of mind, through differently coloured atmopheres. The singer is accompanied with virtuosity by two well-known artists of both jazz and world music. Original music with surprises...

$14:45-15:15$ **Coffee break**

$15:15-16:05$ **Talk by Prof. Günther Rote (Freie Universität Berlin)**
Title: Congruence testing in 4 dimensions

Abstract: Testing two geometric objects for congruence, i.e. whether they are the same up to translations and rotations (and possibly reflections) is a fundamental question of geometry.
In two and three dimensions, the problem has been solved for two n-point sets in optimal $O(n \log n)$ time in the 1970s and 1980s, using various algorithmic techniques such as string matching and planar graph isomorphism.
In d dimensions, for small constant d, the fastest previous algorithm is a randomized Monte Carlo algorithm of Akutsu (and Matoušek), which takes time $O(n^{\lfloor d/2 \rfloor/2} \log n)$. It uses a dimension reduction technique and closest-pair graphs. Some people believe that the problem should be solvable in $O(n \log n)$ time in any fixed dimension d.
Recently, in joint work with Heuna Kim, we have made come progress on this question by finding an algorithm for solving the 4-dimensional problem in $O(n \log n)$ time. I will give some glimpses into the components of this algorithm. It is based on the structure of four-dimensional rotations, Hopf fibrations, and the regular polytopes.

$16:05-16:30$ **Ligia Loretta Trio - Learning to Fly**