Michael Wallner

Curriculum Vitae

Date of birth: 03.12.1987
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I am currently a Postdoctoral researcher at the at the Laboratoire d'Informatique de Paris Nord at the Université Paris 13 under the supervision of Cyril Banderier.

Education

11/2013 – 01/2017 **PhD in Mathematics**, *TU Wien*, Austria, Analytic combinatorics, discrete mathematics, lattice paths, compacted trees.
Promotio sub auspiciis prasidentis rei publicae (Graduation with highest national distinction)

09/2011 – 09/2012 **Master of Science (MSc)**, *Brunel University London*, United Kingdom, Computational Mathematics with Modelling.
Focus: FEM- and BEM-Methods for PDEs, Variational Calculus, Perturbation Theory, Integral Equations, Monte Carlo Methods for Asset Pricing
Thesis Title: "Algebraic Multigrid Methods for Higher-Order Finite Element Discretization with Parallelization" supervised by Matthias Maischak
Graduated with highest distinction

07/2011 – 10/2013 **Master of Science (Dipl.-Ing.)**, *TU Wien*, Austria, Technical Mathematics in the Computer Sciences.
Focus: Discrete Mathematics, Calculus, Algebra, IT Security, Cryptography, Programming
Thesis Title: "Lattice Path Combinatorics" supervised by Michael Drmota
Graduated with highest distinction

10/2008 – 07/2011 **Bachelor of Science (BSc)**, *TU Wien*, Austria, Technical Mathematics in the Computer Sciences.

07/2007 – 01/2008 **Military service**, *Medic*, Austria.

09/2002 – 06/2007 **HTBL Pinkafeld – Höhere Lehranstalt für EDV und Organisation**, Austria.
Austrian Matura passed with distinction

PhD thesis

Title *Combinatorics of Lattice Paths and Tree-like Objects*

Supervisor Bernhard Gittenberger, TU Wien

Description The thesis is concerned with the enumerative and asymptotic analysis of directed lattice paths and tree-like structures. In the first part, several new models for lattice paths are introduced and some of their characterizing parameters, such as the number of returns to zero, or their average height and final altitude are analyzed. In the second part, enumerative and asymptotic results on compacted binary trees are solved. Such trees are a special class of directed acyclic graphs arising from a compressing method.

Work experience

09/2017 – **Postdoctoral position**, *Université Paris 13, Laboratoire d'Informatique de Paris*
present *Nord, Paris.*

05/2017 – **Postdoctoral position**, *Academia Sinica, Institute of Statistical Science, Taipei.*
07/2017

02/2017 – **Postdoctoral position**, *TU Wien, Institute of Discrete Mathematics and Geom-*
04/2017 *etry*, SFB F50-03: Combinatorics of Tree-Like Structures and Enriched Trees.

09/2015 – **External lecturer (side job)**, *FH Campus Wien – University of Applied Sciences.*
01/2017 Small group tutoring in "Calculus 1" for electrical engineering students.

11/2013 – **Graduate teaching and research assistant**, *TU Wien, Institute of Discrete*
04/2017 *Mathematics and Geometry.*
Performed independent research towards obtaining a PhD, disseminated research results, undertook various teaching and grading duties.

10/2012 – **Undergraduate teaching assistant**, *TU Wien, Institute of Discrete Mathematics*
01/2013 *and Geometry.*
Small group tutoring in numerical mathematics.

2004 – 2011 **Internships**, (of 1–2 months).
2010/2011 AIT - Austrian Institute of Technologie, Donau-City-Str. 1, 1220 Wien.
2009 T-Systems Austria, Rennweg 97-99, 1030 Wien.
2008 Marriott Vacation Club International, 4700 Kinsale Road, Cork, Ireland.
2006 Telekom Austria AG, Lasallestr. 9, 1020 Wien.
2005 Kapsch Carrier.Com, Am Euro-Platz 5, 1120 Wien.
2004 Raiffeisen Bank International, Mooslackeng. 25, 1190 Wien.

Teaching

All courses were taught in German and were exercise classes (German: Übung).

TU Wien
2015/2016 Discrete Methods (Diskrete Methoden)
Analysis for Computer Science (Analysis für Informatik und Wirtschaftsinformatik)
2014/2015 Discrete Methods (Diskrete Methoden)
Analysis for Computer Science (Analysis für Informatik und Wirtschaftsinformatik)
Algebra and Discrete Mathematics (Algebra und Diskrete Mathematik für Informatik und Wirtschaftsinformatik)
2013/2014 Discrete Methods (Diskrete Methoden)
Algebra and Discrete Mathematics (Algebra und Diskrete Mathematik für Informatik und Wirtschaftsinformatik)
2012/2013 Numerical Analysis (Numerische Mathematik)

FH Campus Wien – University of Applied Sciences
2016/2017 Analysis 1
2015/2016 Analysis 1

Lectures

2015 Invited course "An Invitation to Analytic Combinatorics and Lattice Path Counting", 3rd ALEA in Europe Young Researchers' Workshop, University of Bath, UK

Research areas

My main interest lies within (analytic) combinatorics, with an emphasis both on exact and asymptotic results for the enumeration of labeled and unlabeled structures and on probabilistic limit laws for combinatorial parameters. In line with this interest, my main focus areas are lattice path combinatorics and tree-like structures, but I am also interested in the application of methods from analytic combinatorics to number theory.

Lattice paths Kernel method, new "unconventional" models (e.g. catastrophes, reflection, absorption, etc.), limit laws, applications

Trees Compacted trees, directed acyclic graphs, Pólya trees, parameters

Number theory Divisibility by prime numbers, applications of generating functions

Scientific activity

Publications 9 peer-reviewed publications, 6 additional scientific articles submitted, see Publications on page 4 for details

Talks 22 talks at international events

Reviews Article reviewing for international journals and conferences

Computer skills

Programming Java, C++, Fortran, Matlab, Maple

Database Oracle, MySQL, SAP

Network Cisco CCNA-Education

Publishing Latex, Microsoft Office, LibreOffice, HTML

Languages

German **Mother tongue**

English **Proficiency (C2)**

Hungarian **Independent user (B1)**

French **Basic user (A1)**

Interests

Guitar 17 years of attending the music school Oberwart, member of different ensembles, participation at several concerts, ongoing member of the church ensemble Unterwart

Climbing Member of Alpenverein Edelweiss (Austrian climbing society)

Other Hiking, skiing, gym, board games, books

Organizational skills

2017 Member of organizing committee of the ALEA in Europe Workshop, Vienna, Austria

2017	Member of organizing committee of the European Conference on Combinatorics, Graph Theory and Applications, Vienna, Austria
2016	Member of organizing committee of the 4th ALEA in Europe Young Researcher's Workshop, Vienna, Austria
2015	Member of organizing committee of AofA'15, Strobl, Austria.
2014 – present	Administrator of the website of the seminar of the Arbeitsgemeinschaft Diskrete Mathematik, TU Wien, Austria.
2013 – 2017	Teaching support at the Institute of Discrete Mathematics and Geometry, TU Wien, Austria.
2011 – 2012	Student representative of course "Computational Mathematics with Modelling" at Brunel University London
2007	Team leader during final year project "Vienna Online Diabetes Education" at HTBL Pinkafeld, First prize at school competition "Jugend Innovativ", category ICT
2007	Quality management technician after ISO 9001
2005	Driving license category B (Austria)

Publications

submitted	*The Tu–Deng conjecture holds almost surely* with Lukas Spiegelhofer, 19 pages, preprint available at `arxiv.org/abs/1707.07945`.
submitted	*A bijection of plane increasing trees with relaxed binary trees of right height at most one* 15 pages, preprint available at `arxiv.org/abs/1706.07163`.
submitted	*On the shape of random Pólya structures* with Bernhard Gittenberger and Emma Yu Jin, 22 pages, preprint available at `arxiv.org/abs/1707.02144`.
submitted	*Asymptotic enumeration of compacted binary trees* with Antoine Genitrini, Bernhard Gittenberger, Manuel Kauers, 43 pages, preprint available at `arxiv.org/abs/1703.10031`.
submitted	*A half-normal distribution scheme for generating functions* 24 pages, preprint available at `arxiv.org/abs/1610.00541`.

Peer-reviewed Journals and Book Series

accepted	*Lattice paths with catastrophes* with Cyril Banderier, Discrete Mathematics and Theoretical Computer Science, 2017, preprint available at `arxiv.org/abs/1707.01931`.
accepted	*An explicit generating function arising in counting binomial coefficients divisible by powers of primes* with Lukas Spiegelhofer, Acta Arithmetica, 2017, preprint available at `arxiv.org/abs/1604.07089`.

accepted *Explicit formulas for enumeration of lattice paths: basketball and the kernel method*
with Cyril Banderier, Christian Krattenthaler, Alan Krinik, Dmitry Kruchinin, Vladimir Kruchinin and David Nguyen, Developments in Mathematics Series, Springer, 2017, preprint available at `arxiv.org/abs/1609.06473`.

accepted *The kernel method for lattice paths below a line of rational slope*
with Cyril Banderier, Developments in Mathematics Series, Springer, 2017, preprint available at `arxiv.org/abs/1606.08412`.

Peer-reviewed Proceedings

2017 *Lattice paths with catastrophes*
with Cyril Banderier, Electronic Notes in Discrete Mathematics, 59:131-146, 2017.

2017 *A note on the scaling limits of random Pólya trees*
with Bernhard Gittenberger and Emma Yu Jin, 2017 Proceedings of the Fourteenth Workshop on Analytic Algorithmics and Combinatorics (ANALCO), 85-93, 2017, preprint available at `arxiv.org/abs/1606.08769`.

2016 *A half-normal distribution scheme for generating functions and the unexpected behavior of Motzkin paths*
in Proceedings of the 27th International Conference on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (`http://www.aofa2016.meetings.pl/`), Krakow, pages 341-352, preprint available at `arxiv.org/abs/1605.03046`.

2016 *The reflection-absorption model for directed lattice paths*
with Cyril Banderier, in Proceedings of the Vienna Young Scientists Symposium (`http://vss.tuwien.ac.at/home/`), Vienna, pages 98-99.

2015 *Lattice paths of slope 2/5*
with Cyril Banderier, in Proceedings of the Twelfth Workshop on Analytic Algorithmics and Combinatorics (ANALCO), San-Diego, pages 105-113, preprint available at `arxiv.org/abs/1605.02967`.

2014 *Some reflections on directed lattice paths*
with Cyril Banderier, in Proceedings of the 25th International Conference on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (AofA 2014) (`http://www.aofa14.upmc.fr/`), Paris, pages 25-36, preprint available at `arxiv.org/abs/1605.01687`.

Theses

2017 *Combinatorics of lattice paths and tree-like structures*
PhD thesis, TU Wien, Vienna.

2013 *Lattice path combinatorics*
Master's thesis, TU Wien, Vienna.

2012 *Algebraic multigrid methods for higher-order finite element discretization with parallelization*
Master's thesis, Brunel University, London.