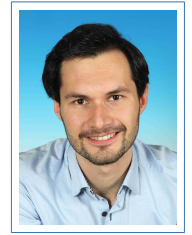


Michael Wallner

Curriculum Vitae



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Personal

Date of birth December 3rd, 1987 (34 years) in Oberwart
Citizenship Austria
Family status married (2017), 1 son (2020), 1 daughter (2021)

Education

- 11/2013–01/2017 **PhD in Mathematics**, *TU Wien*, Austria, Analytic combinatorics, discrete mathematics, lattice paths, compacted trees.
Dissertation: „Combinatorics of Lattice Paths and Tree-like Objects“ supervised by Prof. Dr. Bernhard Gittenberger
Promotio sub auspiciis presidentis rei publicae (Graduation with highest national distinction), awarded on 05/12/2017 by the Austrian president Dr. Alexander Van der Bellen
- 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 Prof. Dr. 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 Prof. Dr. Michael Drmota
Graduated with highest distinction
- 10/2008–07/2011 **Bachelor of Science (BSc)**, *TU Wien*, Austria, Technical Mathematics in the Computer Sciences.
Thesis Title: “Polynomials over finite fields” supervised by Prof. Dr. Michael Drmota
Graduated with highest distinction
- 07/2007–01/2008 **Military service**, *Medic*, Austria.
- 09/2002–06/2007 **HTL Pinkafeld, Abteilung EDV und Organisation**, Austria.
Austrian Matura passed with distinction

PhD thesis at TU Wien

- Title *Combinatorics of Lattice Paths and Tree-like Objects*
- Supervisor Prof. Dr. 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.
- TU Wien The TU Wien is one of the main universities in Vienna, Austria. It has more than 28 000 students enrolled in 18 bachelor’s, 33 master’s, and 3 PhD programs; it has 8 faculties and about 5 000 staff members (3 800 academics). The university’s teaching and research focuses on computer science, quantum physics, engineering, and natural sciences. For more information see www.tuwien.at.

Academic work experience

- Since 02/2020 **Postdoc and PI (FWF J 4162 and P 34142)**, *TU Wien, Institute of Discrete Mathematics and Geometry, Vienna*, 1 year return phase of FWF J 4162; FWF Stand-Alone Project P 34142.
- 01/2021–03/2021 **Paternity leave.**
- 02/2018–01/2020 **Postdoc as Erwin Schrödinger Fellow (FWF J 4162)**, *Université de Bordeaux, Laboratoire Bordelais de Recherche en Informatique (LaBRI), Bordeaux.*
- 09/2017–12/2017 **Postdoc**, *Université Paris 13, Laboratoire d'Informatique de Paris Nord (LIPN), Paris.*
- 05/2017–07/2017 **Postdoc**, *Academia Sinica, Institute of Statistical Science, Taipei.*
- 02/2017–04/2017 **Postdoc**, *TU Wien, Institute of Discrete Mathematics and Geometry, Vienna.*
- 09/2015–01/2017 **External lecturer**, *FH Campus Wien - University of Applied Sciences, Vienna.*
Small group tutoring in "Calculus 1" for electrical engineering students.
- 11/2013–04/2017 **Graduate teaching and research assistant**, *TU Wien, Institute of Discrete Mathematics and Geometry, Vienna.*
Research in FWF project SFB F50-03; teaching and teaching administration in computer science BSc courses.
- 10/2012–01/2013 **Undergraduate teaching assistant**, *TU Wien, Institute of Analysis and Scientific Computing, Vienna.*
Small group tutoring in numerical mathematics.

Grants

- 04/2021–07/2024 FWF Stand-Alone Project P 34142 *Stretched exponentials and beyond*, Principal investigator, 400k€
- 02/2018–03/2021 FWF Erwin Schrödinger-Fellowship J 4162 *Combinatorial and probabilistic study of higher dimensional lattice paths and tree-like structures*, Principal investigator, 157k€
- 12/2017–12/2019 Exzellenzstipendium für sub auspiciis Praesidentis Promovierende (Scholarship of excellence), 9k€
- 2012–2013 TUtheTOP Excellence programme at TU Wien
- 2011–2012 Erasmus Scholarship Brunel University London
- 2011 Julius-Raab-Stipendium
- 2010 Athens Programme, Leuven, Belgium
- 2009–2013 Leistungsstipendium der TU Wien (Excellence scholarship; 5 years in a row)

Teaching

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

FH Campus Wien - University of Applied Sciences

2016/2017 Analysis 1

2015/2016 Analysis 1

TU Wien

2021/2022 Discrete Mathematics

2015/2016 Discrete Methods, Analysis for Computer Science

2014/2015 Discrete Methods, Analysis for Computer Science, Algebra and Discrete Mathematics

2013/2014 Discrete Methods, Algebra and Discrete Mathematics

2012/2013 Numerical Analysis

Lecture

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

Student supervision

- Since 09/2021 PhD student Manosij Ghosh Dastidar in my FWF Project P 34142 (co-supervised with Bernhard Gittenberger)

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 paths and tree-like structures, but I am also interested in finding other applications of combinatorial and probabilistic tools.

- Comb. models Directed acyclic graphs, phylogenetic networks, Pólya trees, limit laws
- Biology Enumeration, limiting objects, random generation
- Random walks New “unconventional” models (e.g., catastrophes, reflection, absorption, etc.), enumeration, limit laws and limiting objects, queueing theory

Scientific activity

- Publications 28 peer-reviewed publications, 1 accepted, 4 submitted; see section Publications.
- Talks 55 talks and 2 poster presentations at international events; see sections Talks and Posters.
- Reviews Article reviewing for international journals and conferences:
 - Journal of Combinatorial Theory, Series A
 - Electronic Journal of Combinatorics
 - Annals of Combinatorics
 - Discrete Mathematics
 - Discrete Mathematics and Theoretical Computer Science
 - Journal of Integer Sequences
 - Séminaire Lotharingien de Combinatoire
 - Online Journal of Analytic Combinatorics
 - Proceedings of Formal Power Series and Algebraic Combinatorics (FPSAC)
 - Proceedings of the International Meeting on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (AofA)
 - Proceedings of the International Conference on Lattice Path Combinatorics & Applications
 - Birkhäuser Science Lecture Notes in Applied and Numerical Harmonic Analysis series
 - Mathematical Reviews (<https://mathscinet.ams.org>)
 - Zentralblatt (<https://zbmath.org>)

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 (A2)

Interests

- Guitar 17 years of attending the music school Oberwart, member of different ensembles, participation at several concerts, longterm member of the church ensemble Unterwart
- Climbing Member of Alpenverein Edelweiss (Austrian climbing society)
- Other Hiking, skiing, gym, board games, books

Esteem factors

- 2022 Organizing committee member of *Computational Logic and Applications*, Vienna, Austria
- 2021 Organizing committee member of *Lattice Path Combinatorics and Interactions*, Luminy, France
- 2020 Program committee member of *Computational Logic and Applications*, online
- 2020 Scientific and organizing committee member of *L'École de Jeunes Chercheurs en Informatique Mathématique* (EJCIM2020), Bordeaux, France and online
- 2017 Organizing committee member of *ALEA in Europe Workshop*, Vienna, Austria
- 2017 Organizing committee member of the *European Conference on Combinatorics, Graph Theory and Applications*, Vienna, Austria
- 2016 Organizing committee member of the *4th ALEA in Europe Young Researcher's Workshop*, Vienna, Austria
- 2015 Organizing committee member of *AofA 2015*, Strobl, Austria
- 2014–today 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 “Computational Mathematics with Modelling” at Brunel University London, UK
- 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)

Popularization

- Since 2020 Member of the TUForMath team; responsible for interactions between mathematics and biology and school excursions in the Natural History Museum Vienna.
- 05/2021 Public lecture at TUForMath: *Das 1x1 des evolutinären Stammbaums (German)*, TU Wien, Austria, 06/05/2021.
- 09/2019 Newspaper article *Analysen von Algorithmen und Ahnenbäume* about my life in Bordeaux appeared in “*Die Presse*”, 13/09/2019.
- 08/2019 Magazine article *Pfade und Bäume in Bordeaux* about my experiences as a Schrödinger-Fellow in Bordeaux, *scilog-Magazin des Wissenschaftsfonds FWF*, 07/08/2019.
- 12/2018 Talk at the 7th Weihnachtskolloquium: *Asymptotic Enumeration of Compacted Binary Trees*, TU Wien, Austria, 21/12/2018.

Major research achievements

- (1) Asymptotic enumeration of **phylogenetic networks** and other **minimal DFAs** using the Airy function
- (2) Counting and sampling gene families in phylogenetic **duplication-loss-transfer models**
- (3) Analyzing typical shapes of **periodic Young tableaux** and **periodic Pólya urns**
- (4) Solving lattice path models including a conjecture by Donald Knuth on the asymptotics of **periodic LPs**

Publications

The major research achievements and most important publications are marked by their respective number.

Peer-reviewed papers journals

- submitted⁽⁴⁾ *Analytic combinatorics of composition schemes and phase transitions with mixed Poisson distributions* with Cyril Banderier, Markus Kuba, 57 pages, preprint available at arxiv.org/abs/2103.03751.
- submitted⁽⁴⁾ *Walks avoiding a quadrant and the reflection principle* with Mireille Bousquet-Mélou, 48 pages, preprint available at arxiv.org/abs/2110.07633.
- submitted *On the critical exponents of generalized ballot sequences in three dimensions and large tandem walks* 11 pages, preprint available at arxiv.org/abs/2105.12155.

- accepted *The binary digits of $n + t$*
with Lukas Spiegelhofer, *Annali della Scuola Normale Superiore di Pisa, Classe di Scienze*, 27 pages, preprint available at arxiv.org/abs/2005.07167.
- 2021⁽¹⁾ *Compacted binary trees admit a stretched exponential*
with Andrew Elvey Price, Wenjie Fang, *Journal of Combinatorial Theory, Series A*, 177 (2021), 105306, 40 pages, preprint available at arxiv.org/abs/1908.11181.
- 2020⁽³⁾ *Periodic Pólya Urns, the Density Method, and Asymptotics of Young Tableaux*
with Cyril Banderier, Philippe Marchal, *Annals of Probability*, Volume 48, Number 4 (2020), 1921–1965, preprint available at arxiv.org/abs/1912.01035.
- 2020⁽¹⁾ *Asymptotic Enumeration of Compacted Binary Trees of Bounded Right Height*
with Antoine Genitrini, Bernhard Gittenberger, Manuel Kauers, *Journal of Combinatorial Theory, Series A*, Volume 172, May 2020, 44 pages, preprint available at arxiv.org/abs/1703.10031.
- 2020⁽⁴⁾ *A half-normal distribution scheme for generating functions*
European Journal of Combinatorics, Volume 87, Article ID 103138, 21 pages, June 2020, preprint available at arxiv.org/abs/1610.00541.
- 2020⁽²⁾ *Counting and sampling gene family evolutionary histories in the duplication-loss and duplication-loss-transfer models*
with Cedric Chauve, Yann Ponty, *Journal of Mathematical Biology*, 80, pages 1353–1388(2020), preprint available at arxiv.org/abs/1905.04971.
- 2019 *A bijection of plane increasing trees with relaxed binary trees of right height at most one*
Theoretical Computer Science, Volume 755, 10 January 2019, pages 1–12, preprint available at arxiv.org/abs/1706.07163.
- 2019 *The Tu–Deng conjecture holds almost surely*
with Lukas Spiegelhofer, *Electronic Journal of Combinatorics*, Volume 26 (2019), no. 1, Paper 1.28, 28 pp., preprint available at arxiv.org/abs/1707.07945.
- 2018 *On the shape of random Pólya structures*
with Bernhard Gittenberger, Emma Yu Jin, *Discrete Mathematics*, Volume 341, Issue 4, April 2018, pages 896–911, preprint available at arxiv.org/abs/1707.02144.
- 2018 *Divisibility of binomial coefficients by powers of two*
with Lukas Spiegelhofer, *Journal of Number Theory*, Volume 192, November 2018, pages 221–239, preprint available at arxiv.org/abs/1710.10884.
- 2017 *An explicit generating function arising in counting binomial coefficients divisible by powers of primes*
with Lukas Spiegelhofer, *Acta Arithmetica* 181 (2017), 27–55, preprint available at arxiv.org/abs/1604.07089.
- 2017 *Lattice paths with catastrophes*
with Cyril Banderier, *Discrete Mathematics & Theoretical Computer Science*, September 29, 2017, Vol 19 no. 1, preprint available at arxiv.org/abs/1707.01931.

Peer-reviewed papers in books

- 2019 *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, *Lattice Path Combinatorics and Applications, Developments in Mathematics*, Springer-Verlag, Cham, 2019, pages 78–118, preprint available at arxiv.org/abs/1609.06473.
- 2019⁽⁴⁾ *The kernel method for lattice paths below a line of rational slope*
with Cyril Banderier, *Lattice Path Combinatorics and Applications, Developments in Mathematics*, Springer, Springer-Verlag, Cham, 2019, pages 119–154, preprint available at arxiv.org/abs/1606.08412.

Peer-reviewed papers in proceedings

- submitted⁽¹⁾ *Enumeration of d -combining Tree-Child Networks*
with Yu-Sheng Chang, Michael Fuchs, Hexuan Liu, and Guan-Ru Yu, 12 pp.
- 2021⁽³⁾ *Young tableaux with periodic walls: counting with the density method*
with Cyril Banderier, SLC 85B.47, 12 pp., FPSAC2021, Ramat Gan.
- 2020⁽⁴⁾ *More models of walks avoiding a quadrant*
with Mireille Bousquet-Mélou, LIPIcs, Vol. 159 - Aofa 2020, 8:1–8:14, Klagenfurt.
- 2020⁽¹⁾ *Asymptotics of minimal deterministic finite automata recognizing a finite binary language*
with Andrew Elvey Price, Wenjie Fang, LIPIcs, Vol. 159 - Aofa 2020, 11:1–11:13, Klagenfurt.
- 2020 *Lattice pathology and symmetric functions (extended abstract)*
with Cyril Banderier, Marie-Louise Lackner, LIPIcs, Vol. 159 - Aofa 2020, 2:1–2:16, Klagenfurt.
- 2019⁽⁴⁾ *Combinatorics of nondeterministic walks of the Dyck and Motzkin type*
with Élie de Panafieu, Mohamed Lamine Lamali, ANALCO 2019: 1–12, San Diego, 2019, preprint available at arxiv.org/abs/1812.06650.
- 2019 *De la probabilité de creuser un tunnel*
with Élie de Panafieu, Mohamed Lamine Lamali, AlgoTel 2019, Saint Laurent de la Cabrerisse, 2019, preprint available at HAL 02123269v1.
- 2018⁽³⁾ *Periodic Pólya Urns and an Application to Young Tableaux*
with Cyril Banderier, Philippe Marchal, LIPIcs, Vol. 110 - Aofa 2018, 11:1–11:13, 2018, Uppsala, preprint available at arxiv.org/abs/1806.03133.
- 2018 *Rectangular Young tableaux with local decreases and the density method for uniform random generation*
with Cyril Banderier and Philippe Marchal, CEUR Workshop Proceedings 2113, GASCom 2018:60–68, Athens, 2018, preprint available at arxiv.org/abs/1805.09017.
- 2018 *Local time for lattice paths and the associated limit laws*
with Cyril Banderier, CEUR Workshop Proceedings 2113, GASCom 2018:69–78, Athens, 2018, preprint available at arxiv.org/abs/1805.09065.
- 2017 *Lattice paths with catastrophes*
with Cyril Banderier, Electronic Notes in Discrete Mathematics, 59:131–146, GASCom 2016, La Marana.
- 2017 *A note on the scaling limits of random Pólya trees*
with Bernhard Gittenberger and Emma Yu Jin, ANALCO 85–93, Barcelona, 2017, preprint available at arxiv.org/abs/1606.08769.
- 2016⁽⁴⁾ *A half-normal distribution scheme for generating functions and the unexpected behavior of Motzkin paths*
AofA 2016, Krakow, Poland, pages 341–352, preprint available at arxiv.org/abs/1605.03046.
- 2016 *The reflection-absorption model for directed lattice paths*
with Cyril Banderier, Vienna Young Scientists Symposium, Vienna, pages 98–99.
- 2015⁽⁴⁾ *Lattice paths of slope $2/5$*
with Cyril Banderier, ANALCO, San-Diego, pages 105–113, preprint available at arxiv.org/abs/1605.02967.
- 2014 *Some reflections on directed lattice paths*
with Cyril Banderier, AofA 2014, 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.
- 2011 *Polynome über endlichen Körpern*
Bachelor's thesis, TU Wien.

10 most important scientific talks

All events are links leading to the respective venues. Invited talks are marked with a “*”, international conferences by “I”.

- 10^{I*} *Stretched exponentials and beyond*, 32nd International Conference on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (AofA 2021), Online/Klagenfurt, Austria, June 2021.
- 9^{*I} *Compacted binary trees and minimal automata admit stretched exponentials*, CanaDAM 2021, Online, Canada, May 2021.
- 8^{*I} *More Models of Walks Avoiding a Quadrant*, CanaDAM 2021, Online, Canada, May 2021.
- 7^I *Counting and Sampling Gene Families Evolutionary Histories*, 5th Algorithmic and Enumerative Combinatorics Summer School 2019, Hagenberg, Austria, July 2019.
- 6^{*I} *Periodic Pólya Urns and Asymptotics of Triangular Young tableaux*, Journées de combinatoire de Bordeaux, LaBRI, Bordeaux, France, February 2019.
- 5^{*I} *Limit laws for lattice paths with catastrophes*, Joint Mathematics Meetings 2019, Baltimore, USA, January 2019.
- 4^{*I} *Periodic Pólya urns and an application to Young tableaux*, Journée MathStic - Combinatoire, probabilités, et physique, LIPN, Paris, France, May 2018.
- 3^I *A bijection of plane increasing trees with bounded relaxed binary trees*, Journées ALEA, CIRM, Marseille, France, March 2018.
- 2^{*I} *A half-normal distribution scheme for generating functions*, Asymptotic Analysis of Algorithms & Combinatorial Structures (A3CS), Paris, France, September 2016.
- 1^{*I} *Lattice paths below a line of rational slope*, Final conférence of the MADACA project, Domaine de Chalès, France, June 2016.

Poster presentations

- 2 *Latticepathology and symmetric functions*, Lattice Paths, Combinatorics and Interactions, Online/CIRM, Marseille, France, July 2021.
- 1 *The reflection-absorption model for directed lattice paths*, VIENNA young SCIENTISTS SYMPOSIUM (VSS16), Vienna, Austria, June 2016.

Coauthors

- 1 Cyril Banderier, Université Sorbonne Paris Nord, France, <https://lipn.univ-paris13.fr/~banderier/>
- 2 Mireille Bousquet-Mélou, Université de Bordeaux, France, <https://www.labri.fr/perso/bousquet/>
- 3 Yu-Sheng Chang, National Chengchi University, Taipei, Taiwan, <https://web.math.nccu.edu.tw/mfuchs/>
- 4 Cedric Chauve, Simon Fraser University, Canada, <http://www.cecm.sfu.ca/~cchauve/>
- 5 Élie de Panafieu, Bell Labs, Paris, France, <https://www.lincs.fr/people/elie-de-panafieu/>
- 6 Andrew Elvey Price, Université de Bordeaux, France, <https://www.idpoisson.fr/elveyprice/en/>
- 7 Wenjie Fang, Université Paris-Est Marne-la-Vallée, France, <http://igm.univ-mlv.fr/~wfang/>
- 8 Michael Fuchs, National Chengchi University, Taipei, Taiwan, <https://web.math.nccu.edu.tw/mfuchs/>
- 9 Antoine Genitrini, Sorbonne Université, France, <https://www-apr.lip6.fr/~genitrini/>
- 10 Bernhard Gittenberger, TU Wien, Austria, <https://dmg.tuwien.ac.at/bgitten/>

- 11 Emma Yu Jin, Universität Wien, Austria,
<https://sites.google.com/site/schatzjin/>
- 12 Manuel Kauers, Johannes Kepler Universität, Austria,
<http://kauers.de/>
- 13 Christian Krattenthaler, Universität Wien, Austria,
<https://www.mat.univie.ac.at/~kratt/>
- 14 Alan Krinik, California State Polytechnic University, Pomona, USA,
https://www.researchgate.net/profile/Alan_Krinik
- 15 Dmitry Kruchinin, Tomsk State University, Russia,
https://www.researchgate.net/profile/Dmitry_Kruchinin
- 16 Vladimir Kruchinin, Tomsk State University, Russia,
https://www.researchgate.net/profile/Vladimir_Kruchinin3
- 17 Markus Kuba, FH-Technikum Wien, Austria,
<https://dmg.tuwien.ac.at/kuba/>
- 18 Marie-Louise Lackner, TU Wien, Austria,
<http://marielouise.lackner.xyz/>
- 19 Mohamed Lamine Lamali, Université de Bordeaux, France,
<http://www.labri.fr/perso/mlamali/>
- 20 Liu Hexuan, National Chengchi University, Taipei, Taiwan,
<https://web.math.nccu.edu.tw/mfuchs/>
- 21 Philippe Marchal, Université Sorbonne Paris Nord, France,
<https://www.math.univ-paris13.fr/~marchal/>
- 22 David T. Nguyen, UC Santa Barbara, USA,
<http://web.math.ucsb.edu/~dnguyen/>
- 23 Yann Ponty, École Polytechnique, France,
<http://www.lix.polytechnique.fr/~ponty/>
- 24 Lukas Spiegelhofer, Montanuniversität Leoben, Austria,
<http://dmg.tuwien.ac.at/spiegelhofer/>
- 25 Yu Guan-Ru, National Kaohsiung Normal University, Taiwan,
<https://sites.google.com/site/guanryu0127/>