

Sarah Winkler | Curriculum Vitae

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Research Areas

- automated reasoning, in particular equational reasoning
- verification of processes with data
- term rewriting, in particular termination and completion
- SAT/SMT based program analysis

Higher Education

University of Innsbruck

Doctoral degree in Technical Sciences, cum laude 11/2008–3/2013
supervised by Aart Middeldorp; Thesis: *Termination Tools in Automated Reasoning*

University of Innsbruck

Master degree of Computer Science, cum laude 10/2006–10/2008

University of Innsbruck

Bachelor degree of Computer, cum laude 10/2003–9/2006

Professional Experience

University of Bolzano

postdoctoral researcher 10/2020–
working with Marco Montali on verification of processes with data

Università di Verona

postdoctoral researcher 09/2019–08/2020
working with Maria Paola Bonacina on conflict-driven theorem proving

Conexus AI

consultant 2018–
providing advice on equational theorem proving in the AQL system

University of Innsbruck

postdoctoral researcher 10/2016–9/2019
PI of FWF project *Instantiation- and Learning-Based Methods in Equational Reasoning*

Microsoft Research, Cambridge

research software developer 9/2015–9/2016
working with Nuno Lopes on SMT-based translation validation for C/C++ compilers

Microsoft Research, Cambridge

contractor 4/2015–7/2015
working with Andrey Rybalchenko on invariant inference for Dafny

University of Innsbruck

postdoctoral researcher 4/2013–3/2015
employed on FWF Austria-Japan joint project on *Constrained Rewriting and SMT*

University of Innsbruck

doctoral student

2/2009–1/2013

funded by an ÖAW docfForte grant

Self-Employed

free-lance programmer and web developer

2002–2009

Funded Projects and Awards

FWF Hertha Firnberg project

Instantiation- and Learning-Based Methods in Equational Reasoning
Austrian Science Fund FWF project T789

10/2016–9/2019

ÖAW docfForte grant

Termination Tools in Automated Reasoning

PhD grant awarded by the Austrian Academy of Sciences

2/2010–1/2013

Doktoratsstipendium

Nachwuchsförderung der Universität Innsbruck

PhD scholarship awarded by the University of Innsbruck to promote young scientists

2/2009–1/2010

Studienförderpreis

Deutscher Freundeskreis der Universitäten Innsbrucks

prize awarded for master project

7/2008

Teaching Experience

International Summer School on Rewriting

basic track

together with Aart Middeldorp

2015, 2017, 2019

SAT and SMT Solving

conception and teaching of lecture, University of Innsbruck

summer terms 2018 and 2019

Formal Language and Automata Theory

teaching assistant, University of Innsbruck

winter terms 2009, 2011–2014, 2017

Term Rewriting

teaching assistant, University of Innsbruck

winter terms 2009, 2010, 2011, 2012

Various subjects

teaching assistant, University of Innsbruck

2006–2010

Exercise classes on *Functional Programming, Introduction to Computer Science, Formal Methods, Algorithms and Data Structures*, and *Logic* (one term each)

Event Organization

- 3rd International Workshop on *Automated Reasoning: Challenges, Applications, Directions, Exemplary Achievements* (ARCADE 2021), associated with CADE-28 (joint with Martin Suda)
- 2nd International Workshop on *Automated Reasoning: Challenges, Applications, Directions, Exemplary Achievements* (ARCADE 2019), associated with CADE-27 (joint with Martin Suda)

Participation in Program Committees

- 30th International Joint Conference on Artificial Intelligence (IJCAI 2021)

- 27th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2021)
- 6th International Conference on Formal Structures for Computation and Deduction (FSCD 2021)
- 10th International Workshop on Confluence (IWC 2021)
- 22nd International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNACS 2020)
- Workshop on Practical Aspects of Automated Reasoning (PAAR 2020)
- 23rd International Conference on Logic for Programming, Artificial Intelligence and Reasoning (LPAR-23)
- 9th International Workshop on Confluence (IWC 2020)
- 5th Conference on Artificial Intelligence and Theorem Proving (AITP 2020)
- 27th International Conference on Automated Deduction (CADE-27)
- 8th International Workshop on Confluence (IWC 2019)

Research Visits

Japan Advanced Institute of Science and Technology, Nomi City <i>hosted by Nao Hirokawa</i> four research visits, seven weeks in total	2013–2019
Nagoya University <i>hosted by Naoki Nishida</i> one week	2018
University of Hokkaido, Sapporo <i>hosted by Masahito Kurihara</i> three research visits, eight weeks in total	2013–2019
MIT, Cambridge/United States <i>hosted by Kurt Fendt</i> extending the on-line learning environment <i>Metamedia</i> , three weeks	2006

Presentations

Invited Talks	
Dagstuhl Seminar 19371: Deduction Beyond Satisfiability <i>invited participant</i>	9/2019
ThEdu 2019 <i>invited speaker</i> 8th International Workshop on Theorem Proving Components for Educational Software	8/2019
FSCD 2019 <i>invited speaker</i> 4th International Conference on Formal Structures for Computation and Deduction	6/2019
Dagstuhl Seminar 15381: Information from Deduction: Models and Proofs <i>invited participant</i>	9/2015

Other Presentations.....

I had the opportunity to present 15 publications at international conferences and six contributions to workshops, corresponding to [5, 6, 8, 10, 11, 12, 14, 17, 19, 20, 21, 22, 23, 24, 25] and [27, 29, 30, 31, 32, 33] from the publication list below, respectively.

Further international events where I presented my work include the following:

- 50th TRS Meeting, 2/2019, Atami, Japan
- 46th TRS Meeting, 2/2017, Shinojima, Japan
- Microsoft Research Dafny Mini-Workshop, 7/2015, Redmond, United States
- 41st TRS Meeting, 9/2014, Sapporo, Japan
- Austria-Japan Summer Workshop on Rewriting, 8/2010, Obergurgl, Austria
- Workshop Paris-Innsbruck-Tbilisi, 5/2010, Paris, France

Software

Koala : semantically guided goal sensitive theorem prover	<i>main developer, since 2019</i>
mædmax : conflict-based equational theorem prover [12, 9]	<i>main developer, since 2016</i>
Ctrl : constrained rewrite tool [10, 11]	<i>contributor, 2018</i>
IsaFoR : Isabelle Formalization of Rewriting [1, 8, 16, 17]	<i>contributor, since 2013</i>
TTT2 : termination tool [2, 3]	<i>contributor, 2012–2015</i>
mkb_{TT} : completion tool [4]	<i>main developer, 2008–2015</i>

Language Skills

programming languages and proof assistants: OCaml, Isabelle/HOL, Python, PHP, C++

natural languages: German (mothertongue), English (fluent), Italian (B2)

Publications

Journal Publications

- [1] N. Hirokawa, A. Middeldorp, C. Sternagel, and S. Winkler. Abstract completion, formalized. *Log. Meth. Comput. Sci.*, 15(3):1:1–1:19, 2019. doi: [10.23638/LMCS-15\(3:19\)2019](https://doi.org/10.23638/LMCS-15(3:19)2019).
- [2] A. Yamada, S. Winkler, N. Hirokawa, and A. Middeldorp. AC-KBO Revisited. *Theor. Pract. Log. Prog.*, 16(2):163–188, 2016. doi: [10.1017/S1471068415000083](https://doi.org/10.1017/S1471068415000083).
- [3] H. Zankl, S. Winkler, and A. Middeldorp. Beyond Polynomials and Peano Arithmetic — Automation of Elementary and Ordinal Interpretations. *J. Symb. Comput.*, 69(C):129–158, 2015. doi: [10.1016/j.jsc.2014.09.033](https://doi.org/10.1016/j.jsc.2014.09.033).
- [4] S. Winkler, H. Sato, A. Middeldorp, and M. Kurihara. Multi-completion with termination tools. *J. Autom. Reasoning*, 50(3):317–354, 2013. doi: [10.1007/s10817-012-9249-2](https://doi.org/10.1007/s10817-012-9249-2).

Conference Publications

- [5] S. Winkler and G. Moser. Runtime complexity analysis of logically constrained rewriting. In *Proc. 30th LOPSTR*, LNCS, 2021. To appear.
- [6] M. P. Bonacina and S. Winkler. SGGS decision procedures. In *Proc. 10th IJCAR*, volume 12166 of LNCS, pages 356–374, 2020. doi: [10.1007/978-3-030-51074-9_20](https://doi.org/10.1007/978-3-030-51074-9_20) Nominated for best paper award.
- [7] S. Winkler and A. Middeldorp. Tools in term rewriting for education. In *Proc. 8th ThEdu*, volume 313 of EPTCS, pages 54–72, 2020. doi: [10.4204/EPTCS.313.4](https://doi.org/10.4204/EPTCS.313.4).
- [8] C. Sternagel and S. Winkler. Certified equational reasoning via ordered completion. In *Proc. 27th CADE*, volume 11716 of LNCS, pages 508–525, 2019. doi: [10.1007/978-3-030-29436-6_30](https://doi.org/10.1007/978-3-030-29436-6_30).
- [9] S. Winkler. Extending maximal completion. In *Proc. 4th FSCD*, volume 131 of LIPIcs, pages 3:1–3:15, 2019. doi: [10.4230/LIPIcs.FSCD.2019.3](https://doi.org/10.4230/LIPIcs.FSCD.2019.3).
- [10] N. Nishida and S. Winkler. Loop detection by logically constrained term rewriting. In *Proc. 10th VSTTE*, volume 11294 of LNCS, pages 309–321, 2018. doi: [10.1007/978-3-030-03592-1_18](https://doi.org/10.1007/978-3-030-03592-1_18).
- [11] S. Winkler and A. Middeldorp. Completion for logically constrained rewriting. In *Proc. 3rd FSCD*, volume 108 of LIPIcs, pages 30:1–30:18, 2018. doi: [10.4230/LIPIcs.FSCD.2018.30](https://doi.org/10.4230/LIPIcs.FSCD.2018.30).
- [12] S. Winkler and G. Moser. Mædmax: A maximal ordered completion tool. In *Proc. 9th IJCAR*, volume 10900 of LNCS, pages 472–480, 2018. doi: [10.1007/978-3-319-94205-6_31](https://doi.org/10.1007/978-3-319-94205-6_31).
- [13] N. Hirokawa, A. Middeldorp, C. Sternagel, and S. Winkler. Infinite runs in abstract completion. In *Proc. 2nd FSCD*, volume 84 of LIPIcs, pages 19:1–19:16, 2017. doi: [10.4230/LIPIcs.FSCD.2017.19](https://doi.org/10.4230/LIPIcs.FSCD.2017.19).

- [14] H. Sato and S. Winkler. Encoding dependency pair techniques and control strategies for maximal completion. In *Proc. 25th CADE*, volume 9195 of *LNCS*, pages 152–162, 2015. doi: [10.1007/978-3-319-21401-6_10](https://doi.org/10.1007/978-3-319-21401-6_10).
- [15] T. Sternagel, S. Winkler, and H. Zankl. Recording completion for certificates in equational reasoning. In *Proc. 4th CPP*, pages 41–47, 2015. doi: [10.1145/2676724.2693171](https://doi.org/10.1145/2676724.2693171).
- [16] S. Winkler and R. Thiemann. Formalizing soundness and completeness of unravelings. In *Proc. FroCoS 2015*, volume 9322 of *LNCS*, pages 239–255, 2015. doi: [10.1007/978-3-319-24246-0_15](https://doi.org/10.1007/978-3-319-24246-0_15).
- [17] J. Nagele, R. Thiemann, and S. Winkler. Certification of nontermination proofs using strategies and nonlooping derivations. In *Proc. 6th VSTTE*, volume 8471 of *LNCS*, pages 216–232, 2014. doi: [10.1007/978-3-319-12154-3_14](https://doi.org/10.1007/978-3-319-12154-3_14).
- [18] A. Yamada, S. Winkler, N. Hirokawa, and A. Middeldorp. AC-KBO revisited. In *Proc. 12th FLOPS*, volume 8475 of *LNCS*, pages 319–335, 2014. doi: [10.1007/978-3-319-07151-0](https://doi.org/10.1007/978-3-319-07151-0).
- [19] S. Winkler and A. Middeldorp. Normalized completion revisited. In *Proc. 24th RTA*, volume 21 of *LIPICs*, pages 319–334, 2013. doi: [10.4230/LIPICs.RTA.2013319](https://doi.org/10.4230/LIPICs.RTA.2013319).
- [20] S. Winkler, H. Zankl, and A. Middeldorp. Beyond Peano Arithmetic — Automatically Proving Termination of the Goodstein Sequence. In *Proc. 24th RTA*, volume 21 of *LIPICs*, pages 335–351, 2013. doi: [10.4230/LIPICs.RTA.2013335](https://doi.org/10.4230/LIPICs.RTA.2013335).
- [21] S. Winkler, H. Zankl, and A. Middeldorp. Ordinals and Knuth-Bendix orders. In *Proc. 18th RTA*, volume 7180 of *LNCS*, pages 420–434, 2012. doi: [10.1007/978-3-642-28717-6_33](https://doi.org/10.1007/978-3-642-28717-6_33).
- [22] S. Winkler and A. Middeldorp. AC completion with termination tools. In *Proc. 23rd CADE*, volume 6803 of *LNCS*, pages 492–498, 2011. doi: [10.1007/978-3-642-22438-6_37](https://doi.org/10.1007/978-3-642-22438-6_37).
- [23] S. Winkler and A. Middeldorp. Termination tools in ordered completion. In *Proc. 5th IJCAR*, volume 6173 of *LNCS*, pages 518–532, 2010. doi: [10.1007/978-3-642-14203-1_43](https://doi.org/10.1007/978-3-642-14203-1_43).
- [24] S. Winkler, H. Sato, A. Middeldorp, and M. Kurihara. Optimizing mkbTT (system description). In *Proc. 21st RTA*, volume 6 of *LIPICs*, pages 373–384, 2010. doi: [10.4230/LIPICs.RTA.2010.373](https://doi.org/10.4230/LIPICs.RTA.2010.373).
- [25] H. Sato, S. Winkler, M. Kurihara, and A. Middeldorp. Multi-completion with termination tools (system description). In *Proc. 4th IJCAR*, volume 5195 of *LNCS*, pages 306–312, 2008. doi: [10.1007/978-3-540-71070-7_26](https://doi.org/10.1007/978-3-540-71070-7_26).

Thesis.....

- [26] S. Winkler. *Termination Tools in Automated Reasoning*. PhD thesis, University of Innsbruck, 2013.

Workshops and Other Publications.....

- [27] M. Suda and S. Winkler. Learning strategy design: First lessons. In *Proc. 5th Conference on Artificial Intelligence and Theorem Proving*, 2020. To appear.

- [28] M. Suda and S. Winkler, editors. *Proceedings of the Second International Workshop on Automated Reasoning: Challenges, Applications, Directions, Exemplary Achievements (ARCADE 2019)*, volume 311 of *EPTCS*, 2019. doi: [10.4204/EPTCS.311](https://doi.org/10.4204/EPTCS.311).
- [29] S. Winkler. Mædmax at school: Learning selection in equational reasoning. In *Proc. 4th Conference on Artificial Intelligence and Theorem Proving*, pages 38–40, 2019.
- [30] S. Winkler and G. Moser. Smarter features, simpler learning? In *Proc. 2nd ARCADE*, volume 311 of *EPTCS*, pages 25–31, 2019. doi: [10.4204/EPTCS.311.4](https://doi.org/10.4204/EPTCS.311.4).
- [31] C. Sternagel and S. Winkler. Certified ordered completion. In *Proc. 7th International Workshop on Confluence*, pages 41–45, 2018.
- [32] S. Winkler. A ground joinability criterion for ordered completion. In *Proc. 6th International Workshop on Confluence*, pages 45–49, 2017.
- [33] H. Sato and S. Winkler. A satisfiability encoding of dependency pair techniques for maximal completion. In *Proc. 14th International Workshop on Termination*, pages 80–84, 2014.
- [34] H. Zankl, S. Winkler, and A. Middeldorp. Automating elementary interpretations. In *Proc. 14th International Workshop on Termination*, pages 90–94, 2014.
- [35] H. Zankl, S. Winkler, and A. Middeldorp. Automating ordinal interpretations. In *Proc. 12th International Workshop on Termination*, pages 94–98, 2012.
- [36] H. Sato, M. Kurihara, S. Winkler, and A. Middeldorp. Constraint-based multi-completion procedures for term rewriting systems. *IEICE Transactions on Information and Systems*, E92-D(2):220–234, 2009.
- [37] C. Sternagel, R. Thiemann, S. Winkler, and H. Zankl. CeTA — a tool for certified termination analysis. In *Proc. 10th International Workshop on Termination*, pages 84–87, 2009.