# Theorem prover with equality

master thesis in computer science

by

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Master Thesis

# Yet another first order theorem prover with equality

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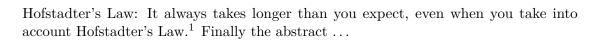
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#### **Abstract**



<sup>1</sup> Douglas Hofstadter, Gödel, Escher, Bach: An Eternal Golden Braid

# Acknowledgments

Thanks for all the fish.

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# 1 Introduction

#### 1.0.1 Minimal memory footprint in C without sharing

```
A inner node includes a symbol pointer and char * symbol 
typedef struct {
char *symbol;
Node **nodes;
} Node;
```

## **Bibliography**

- [1] L. Bachmair, N. Dershowitz, and D. A. Plaisted. Completion without failure, 1989.
- [2] L. Bachmair and H. Ganzinger. Rewrite-Based Equational Theorem Proving with Selection and Simplification. *Journal of Logic and Computation*, pages 217–247, 1991.
- [3] L. Bachmair and H. Ganzinger. Equational reasoning in saturation-based theorem proving, pages 353–397, 1998.
- [4] L. Bachmair and H. Ganzinger. Strict basic superposition. In Kirchner and Kirchner [15], pages 160–174.
- [5] P. Baumgartner and C. Tinelli. The model evolution calculus with equality. pages 392–408.
- [6] P. Baumgartner and C. Tinelli. The Model Evolution Calculus. In F. Baader, editor, CADE-19 – The 19th International Conference on Automated Deduction, volume 2741 of Lecture Notes in Artificial Intelligence, pages 350–364. Springer, 2003.
- [7] P. Baumgartner and C. Tinelli. The Model Evolution Calculus. In *CADE-19*. *Proceedings*, volume 2741 of *LNAI*, pages 350–364, 2003.
- [8] P. Baumgartner and C. Tinelli. The Model Evolution Calculus with Equality. In *CADE-20*, pages 392–408, 2005.
- [9] A. Fuchs. Darwin: A Theorem Prover for the Model Evolution Calculus. Master's thesis, University of Koblenz-Landau, 2004.
- [10] H. Ganzinger and K. Korovin. New Directions in Instantiation-Based Theorem Proving. In 18th LICS 2003. Proceedings, pages 55–64. IEEE, 2003.
- [11] H. Ganzinger and K. Korovin. Integrating Equational Reasoning into Instantiation-Based Theorem Proving. In 18th CSL 2004. Proceedings, volume 3210 of LNCS, pages 71–84, 2004.
- [12] N. Hirokawa and A. Middeldorp. Polynomial interpretations with negative coefficients. In Proceedings of the 7th International Conference on Artificial Intelligence and Symbolic Mathematical Computation, volume 3249 of LNCS, pages 185–198, 2004.
- [13] N. Hirokawa and A. Middeldorp. Tyrolean termination tool: Techniques and features. *Information and Computation*, 205(4):474–511, 2007.

- [14] M. Huth and M. Ryan. Logic in Computer Science: Modelling and Reasoning about Systems. Cambridge University Press, 2004.
- [15] C. Kirchner and H. Kirchner, editors. Automated Deduction CADE-15, 15th International Conference on Automated Deduction, Lindau, Germany, July 5-10, 1998, Proceedings, volume 1421 of Lecture Notes in Computer Science. Springer, 1998.
- [16] D. Klein and N. Hirokawa. Maximal Completion. In 22nd RTA 2011. Proceedings, pages 71–80, 2011.
- [17] K. Korovin. Inst-Gen a Modular Approch. In *IJCAR 2008. Proceedings*, pages 292–298.
- [18] K. Korovin. iProver An Instantiation-Based Theorem Prover for First-Order Logic (System Description). In *IJCAR 2008. Proceedings*, pages 292–298, 2008.
- [19] K. Korovin and C. Sticksel. iProver-Eq: An Instantiation-Based Theorem Prover with Equality. In *IJCAR 2010. Proceedings*, volume 6173 of *LNAI*, pages 196–202, 2010.
- [20] A. Leitsch. *The Resolution Calculus*. Texts in theoretical computer science. Springer, 1997.
- [21] A. Middeldorp. Lecture Notes Term Rewriting, 2015.
- [22] G. Moser. Lecture Notes Module Automated Reasoning. cl-informatik.uibk.ac.at/teaching/ws13/cl/content.php, 2014.
- [23] A. Riazanov and A. Voronkov. Efficient instance retrieval with standard and relational path indexing. In F. Baader, editor, Automated Deduction – CADE-19, volume 2741 of Lecture Notes in Computer Science, pages 380–396. Springer Berlin Heidelberg, 2003.
- [24] H. Sato and S. Winkler. A Satisfiability Encoding of Dependency Pair Techniques for Maximal Completion. In 14th WST 2014. Proceedings, pages 80–84, 2014.
- [25] R. Sekar, I. V. Ramakrishnan, and A. Voronkov. Term indexing. In A. Robinson and A. Voronkov, editors, *Handbook of Automated Reasoning*, chapter Term Indexing, pages 1853–1964. Elsevier Science Publishers B. V., Amsterdam, The Netherlands, The Netherlands, 2001.
- [26] C. Sticksel. Efficient Equational Reasoning for the Inst-Gen framework. PhD thesis, School of Computer Science, University of Manchester, 2011.
- [27] S. Winkler. Termination Tools in Automated Reasoning. PhD thesis, University of Innsbruck, 2013.
- [28] H. Zankl, N. Hirokawa, and A. Middeldorp. KBO Orientability. *Journal of Automated Reasoning*, 43(2):pp. 173–201, Aug. 2009.