

## PUBLICATION LIST

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### Highlighted publications

Unless a different URL is given, my highlighted publications are available at <http://www4.informatik.tu-muenchen.de/~schulz/bibliography.html>.

1. S. Schulz. E – A Brainiac Theorem Prover. *Journal of AI Communications*, 15(2/3):111–126, 2002.

The equational theorem prover E is the vehicle for much of my current research and is widely used by other researchers. According to *Google Scholar*, this publication has been cited more than 120 times, both by system and by application papers.

2. S. Schulz. A Comparison of Different Techniques for Grounding Near-Propositional CNF Formulae. In S. Haller and G. Simmons, editors, *Proc. of the 15th FLAIRS, Pensacola*, pages 72–76. AAAI Press, 2002.

This paper describes an number of optimizations for transforming groundable first-order formulas in clause normal form into equisatisfiable ground formulas. The two strongest contenders in the CASC-JC EPR competition both implemented the techniques described in this paper. The paper won the best paper award at FLAIRS-2002.

3. S. Schulz and M.P. Bonacina. On Handling Distinct Objects in the Superposition Calculus. In B. Konev and S. Schulz, editors: *Proc. of the Fifth International Workshop on the Implementation of Logics, Montevideo, Uruguay*, 2005.

By default, first order semantic allows syntactically different constants to be equal. This requires large explicit specifications ( $O(n^2)$  axioms for  $n$  constants) if e.g. a unique name assumption must be specified. Here we describe an extension of the superposition calculus that can handle distinct objects at the calculus level. Soundness and completeness of the calculus are shown.

4. Alessandro Armando, Maria Paola Bonacina, Silvio Ranise, and Stephan Schulz. New Results on Rewrite-Based Satisfiability Procedures. *ACM Transactions on Computational Logic*, 2008. Available at <http://toc1.acm.org/accepted.html>.

The paper deals with the decidability of several important background theories used in the *satisfiability modulo theories* approach popular for

verification tasks and model checking. It shows that a properly configured rewrite-based first-order theorem prover can decide many important theories over numbers and data structures, and gives generic results on modularity and combinations of these theories.

## List of Publications

### Edited journal issues

1. Boris Konev, Renate Schmidt and Stephan Schulz (editors). Special Issue: Practical Aspects of Automated Reasoning. *Journal of AI Communications*, 2009. (in progress).
2. Renate Schmidt, Stephan Schulz, and Geoff Sutcliffe (editors). Special Issue: Implementation of Logics. *Journal of Applied Logic*, 2007.
3. Bernd Fischer, Geoff Sutcliffe, and Stephan Schulz (editors). Special Issue: Empirically Successful Automated Reasoning – Applications Issue. *Journal of Automated Reasoning*, 37(1/2), 2006.
4. Bernd Fischer, Geoff Sutcliffe, and Stephan Schulz (editors). Special Issue: Empirically Successful Automated Reasoning – Systems Issue. *Journal of Automated Reasoning*, 36(4), 2006.
5. Boris Konev, Renate Schmidt, and Stephan Schulz (editors). Special Issue: Implementation of Logics. *Journal of Applied Non-Classical Logics*, 16(1/2), 2006.
6. Stephan Schulz, Geoff Sutcliffe, and Tanel Tammet (editors). Special Issue: Empirically Successful First Order Reasoning. *International Journal on Artificial Intelligence Tools*, 15(1), 2006.

### Edited Proceedings

1. Piotr Rudnicki, Geoff Sutcliffe, Boris Konev, Renate Schmidt and Stephan Schulz, editors: *Proceedings of the LPAR Workshops: Knowledge Exchange: Automated Provers and Proof Assistants, and The 7th International Workshop on the Implementation of Logics*, volume 418 of *CEUR Workshop Proceedings*, 2008
2. Boris Konev, Renate Schmidt and Stephan Schulz, editors. *Proceedings of the IJCAR Workshop on Practical Aspects of Automated Reasoning (PAAR)*, 2008
3. Geoff Sutcliffe and Simon Colton and Stephan Schulz, editors. *Proceedings of the CICM Workshop on Empirically Successful Automated Reasoning for Mathematics (ESARM)*, 2008

4. Geoff Sutcliffe, Josef Urban, and Stephan Schulz, editors. *Proceedings of the CADE-21 Workshop on Empirically Successful Automated Reasoning in Large Theories (ESARLT)*, volume 257 of *CEUR Workshop Proceedings*, 2007.
5. Geoff Sutcliffe, Renate Schmidt, and Stephan Schulz, editors. *Proceedings of the FLoC'06 Workshop on Empirically Successful Computerized Reasoning (ESCoR)*, volume 192 of *CEUR Workshop Proceedings*, 2006.
6. Geoff Sutcliffe, Stephan Schulz, and Bernd Fischer, editors. *Proceedings of the CADE Workshop on Empirically Successful Classical Automated Reasoning (ESCAR), Tallinn, Estonia*, 2005.
7. Boris Konev and Stephan Schulz, editors. *Proceedings of the Fifth International Workshop on the Implementation of Logics (IWIL)*, Technical Report of the University of Liverpool, 2005.
8. Geoff Sutcliffe, Stephan Schulz, and Tanel Tammet, editors. *Proceedings of the IJCAR Workshop on Empirically Successful First Order Reasoning (ESFOR), Cork, Ireland*, 2004.
9. Hans de Nivelle and Stephan Schulz, editors. *Proceedings of the Second International Workshop on the Implementation of Logics (IWIL)*, number MPI-I-2001-2-006 in *Forschungsberichte des Max-Planck-Instituts für Informatik*, 2001.

### Authored books

1. S. Schulz. *Learning Search Control Knowledge for Equational Deduction*. Number 230 in DISKI. Akademische Verlagsgesellschaft Aka GmbH Berlin, 2000. Ph.D. Thesis, Fakultät für Informatik, Technische Universität München.

### Book contributions

1. G. Sutcliffe, J. Zimmer, and S. Schulz. TSTP Data-Exchange Formats for Automated Theorem Proving Tools. In W. Zhang and V. Sorge, editors, *Distributed and Constraint Solving and Reasoning in Multi-Agent Systems*, *Frontiers in Artificial Intelligence and Applications* 112. IOS Press, 2004.

### Refereed journal papers

1. Alessandro Armando, Maria Paola Bonacina, Silvio Ranise, and Stephan Schulz. New Results on Rewrite-Based Satisfiability Procedures. *ACM Transactions on Computational Logic*, 2008. (accepted for publication).

2. M. Bozzano, R. Bruttomesso, A. Cimatti, T. Junttila, P. v. Rossum, S. Schulz, R. Sebastiani. MathSAT: Tight Integration of SAT and Mathematical Decision Procedures. *Journal of Automated Reasoning*, 35(1–3):265–293, 2005.
3. S. Schulz. E – A Brainiac Theorem Prover. *Journal of AI Communications*, 15(2/3):111–126, 2002.
4. J. Denzinger and S. Schulz. Automatic Acquisition of Search Control Knowledge from Multiple Proof Attempts. *Journal of Information and Computation*, 162:59–79, 2000.
5. J. Denzinger, M. Kronenburg, and S. Schulz. DISCOUNT: A Distributed and Learning Equational Prover. *Journal of Automated Reasoning*, 18(2):189–198, 1997.
6. J. Denzinger and S. Schulz. Recording and Analysing Knowledge-Based Distributed Deduction Processes. *Journal of Symbolic Computation*, 21(4/5):523–541, 1996.

### Refereed conference and workshop papers

1. Geoff Sutcliffe, Stephan Schulz, Koen Claessen and Allen Van Gelder. Using the TPTP Language for Writing Derivations and Finite Interpretations In: *Proc. of the 3rd IJCAR, Seattle*, volume 4130 of LNAI, pages 67–81, Springer, 2006.
2. Alessandro Armando, Maria Paola Bonacina, Silvio Ranise, and Stephan Schulz. On a Rewriting Approach to Satisfiability Procedures: Extension, Combination of Theories and an Experimental Appraisal. In: *Proc. of the 5th International Workshop on Frontiers of Combining Systems (FroCoS-2005)*, Vienna, volume 3717 of LNCS, pages 65–80, Springer, 2005
3. Alessandro Armando, Maria Paola Bonacina, Silvio Ranise, and Stephan Schulz. Big Proof Engines as Little Proof Engines: New Results on Rewrite-Based Satisfiability Procedures (Extended Abstract). In: *Proc. of the 3rd Workshop on Pragmatics of Decision Procedures in Automated Reasoning (PDPAR-2005)*, Edinburgh, 2005
4. M. Bozzano, R. Bruttomesso, A. Cimatti, T. Junttila, P. v. Rossum, S. Schulz, and R. Sebastiani. The MathSAT 3 System. In R. Nieuwenhuis, editor: *Proc. of the 20th CADE, Tallinn*, volume 3632 of LNCS, pages 315–321, Springer, 2005
5. S. Schulz and M.P. Bonacina. On Handling Distinct Objects in the Superposition Calculus. In B. Konev and S. Schulz, editors: *Proc. of the Fifth International Workshop on the Implementation of Logics, Montevideo, Uruguay*, 2005

6. M. Bozzano, R. Bruttomesso, A. Cimatti, T. Junttila, P. v. Rossum, S. Schulz, and R. Sebastiani. An Incremental and Layered Procedure for the Satisfiability of Linear Arithmetic Logic. In Nicolas Halbwachs and Lenore D. Zuck, editors, *Proc. of the Eleventh International Conference on Tools And Algorithms for the Construction and Analysis of Systems (TACAS-2005)*, volume of 3440 of *LNCS*, pages 317–333, Springer, 2005
7. S. Schulz. Simple and Efficient Clause Subsumption with Feature Vector Indexing. In S. Schulz, G. Sutcliffe, and T. Tammet, editors, *Proc. of the IJCAR-2004 Workshop on Empirically Successful First-Order Theorem Proving, Cork, Ireland, 2004*.
8. S. Schulz. System Description: E 0.81. In D. Basin and M. Rusinowitch, editors, *Proc. of the 2nd IJCAR, Cork, Ireland*, volume 3097 of *LNAI*, pages 223–228. Springer, 2004.
9. G. Sutcliffe, J. Zimmer, and S. Schulz. Communication Formalisms for Automated Theorem Proving Tools. In V. Sorge, S. Colton, M. Fisher, and J. Gow, editors: *Proc. of the IJCAI-18 Workshop on Agents and Automated Reasoning*, pages 53–58, 2003
10. S. Schulz and G. Sutcliffe. System Description: GrAnDe 1.0. In A. Voronkov, editor, *Proc. of the 18th CADE, Copenhagen*, pages 280–284. Springer, 2002.
11. S. Schulz. A Comparison of Different Techniques for Grounding Near-Propositional CNF Formulae. In S. Haller and G. Simmons, editors, *Proc. of the 15th FLAIRS, Pensacola*, pages 72–76. AAAI Press, 2002.
12. B. Löchner and S. Schulz. An Evaluation of Shared Rewriting. In H. de Nivelle and S. Schulz, editors, *Proc. of the 2nd International Workshop on the Implementation of Logics*, pages 33–48, MPI Preprint, 2001.
13. S. Schulz. Learning Search Control Knowledge for Equational Theorem Proving. In F. Baader, G. Brewka, and T. Eiter, editors, *Proc. of the Joint German/Austrian Conference on Artificial Intelligence (KI-2001)*, volume 2174 of *LNAI*, pages 320–334. Springer, 2001.
14. S. Schulz. System Abstract: E 0.61. In R. Goré, A. Leitsch, and T. Nipkow, editors, *Proc. of the 1st IJCAR, Siena*, volume 2083 of *LNAI*, pages 370–375. Springer, 2001.
15. J. Draeger and S. Schulz. Improving the Performance of Automated Theorem Provers by Redundancy-free Lemmatization. In I. Russel and J. Kolen, editors, *Proc. of the 14th FLAIRS, Key West*, pages 345–349. AAAI Press, 2001.
16. S. Schulz. Information-Based Selection of Abstraction Levels. In I. Russel and J. Kolen, editors, *Proc. of the 14th FLAIRS, Key West*, pages 402–406. AAAI Press, 2001.

17. S. Schulz. System Abstract: E 0.3. In H. Ganzinger, editor, *Proc. of the 16th CADE, Trento*, volume 1632 of *LNAI*, pages 297–391. Springer, 1999.
18. S. Schulz and F. Brandt. Using Term Space Maps to Capture Search Control Knowledge in Equational Theorem Proving. In A. N. Kumar and I. Russell, editors, *Proc. of the 12th FLAIRS, Orlando*, pages 244–248. AAAI Press, 1999.
19. S. Schulz. Term Space Mapping for DISCOUNT. In J. Denzinger and B. Spencer, editors, *Proc. of the CADE-15 Workshop on Using AI methods in Deduction, Lindau*, 1998.
20. S. Schulz, A. K uchler, and C. Goller. Some Experiments on the Applicability of Folding Architecture Networks to Guide Theorem Proving. In D.D. Dankel II, editor, *Proc. of the 10th FLAIRS, Daytona Beach*, pages 377–381. Florida AI Research Society, 1997.
21. J. Denzinger and S. Schulz. Learning Domain Knowledge to Improve Theorem Proving. In M.A. McRobbie and J.K. Slaney, editors, *Proc. of the 13th CADE, New Brunswick*, volume 1104 of *LNAI*, pages 62–76. Springer, 1996.
22. M. Schramm and S. Schulz. Combining Propositional Logic with Maximum Entropy Reasoning on Probability Models. In Ilkka Niemelae, editor, *Proc. of the ECAI'96 Workshop on Integrating Nonmonotonicity into Automated Reasoning Systems*, number 18–96 in *Fachberichte Informatik*. Universit at Koblenz-Landau, Institut f ur Informatik, 1996.
23. J. Denzinger and S. Schulz. Recording, Analyzing and Presenting Distributed Deduction Processes. In H. Hong, editor, *Proc. 1st PASCO, Hagenberg/Linz*, volume 5 of *Lecture Notes Series in Computing*, pages 114–123, Singapore, 1994. World Scientific Publishing.

### Other publications (selected)

1. Stephan Schulz. Breaking Barriers - Why and how ADS-B and multilateration technology will become the leader in future surveillance deployments. *Air Traffic Technology International 2008*, pages 88–91, 2008.
2. Stephan Schulz and Susanne Och. Wide Area Multilateration. Airport International, 2008.
3. S. Schulz. *The E Equational Theorem Prover*. A high-performance theorem prover for first-order logic with equality. 1998-2008.  
<http://www.eprover.org>.
4. S. Schulz. *The E Equational Theorem Prover – User Manual*. Automated Reasoning Group, Institut f ur Informatik, Technische Universit at M unchen, 2004.

5. S. Schulz, S. Sutcliffe. *GrAnDe*. An effective decision procedure for CNF formulae with finite Herbrand universe. 2002.  
<http://www.cs.miami.edu/~tptp/ATPSystems/GrAnDe/>.
6. J. Denzinger, M. Fuchs, C. Goller, and S. Schulz. Learning from Previous Proof Experience. Technical Report AR99-4, Institut für Informatik, Technische Universität München, 1999.
7. J. Denzinger, M. Fuchs, C. Goller, and S. Schulz. Proc. of the CADE-14 tutorial on *Learning from Previous Proof Experience*, Townsville. Distributed to the participants, 1997.
8. S. Schulz. Explanation Based Learning for Distributed Equational Deduction. Diplomarbeit in Informatik, Fachbereich Informatik, Universität Kaiserslautern, 1995.
9. J. Denzinger and S. Schulz. Analysis and Representation of Equational Proofs Generated by a Distributed Completion Based Proof System. Seki-Report SR-94-05, Universität Kaiserslautern, 1994.
10. S. Schulz. Analyse und Transformation von Gleichheitsbeweisen. Projektarbeit in Informatik, Fachbereich Informatik, Universität Kaiserslautern, 1993. (German Language).

### Selected presentations

1. “Improved Air Traffic Control with Cooperative Surveillance”, NICTA, Canberra, Australia, 2008
2. “Implementation of ATC Surveillance Technologies”, ATC-Global Seminar, Amsterdam, The Netherlands, 2008
3. “Algorithms and Data Structures for First-Order Equational Deduction”, invited presentation at the *6th International Workshop on the Implementation of Logics*, Phnom Penh, Cambodia, 2007
4. “The Inside and Outside of E”, invited presentation, *Cooperation of Deduction Tools Day*, INRIA, Nancy, 2006.
5. “Simplicity, Measuring, and Good Engineering: One Way to Build a World Class Automated Deduction System”, invited presentation at the *4th International Workshop on the Implementation of Logics*, Almaty, Kazakhstan, 2003
6. “Learning Search Control Knowledge for Equational Theorem Proving”, University of Miami, Miami, Florida, U.S.A., 2001
7. “Why and How E Works”, invited presentation at the *Reunion Workshop on Implementations of Logic*, Reunion Island, France, 2000

8. “Erlernen von Steuerungswissen für gleichheitsbasiertes Theorembeweisen”, Ph.D. defense, Technische Universität München, Munich, 2000. Also held at the yearly meeting of the GI-Fachgruppe 1.2.1. “Deduktion”, Saarbrücken, Germany, 2000.
9. “E and E-SETHEO”, acceptance speech for the CASC-17 theorem proving competition trophies for the MIX and SEM categories, Trento, Italy, 1999
10. “Some Experiments on the Applicability of Folding Architecture Networks to Guide Theorem Proving”, implementor- and user meeting of the DFG focus program *Deduktion*, Berlin, Germany, 1997
11. “Learning from Previous Proof Experience” (with J. Denzinger, M. Fuchs, and C. Goller), CADE-14 Tutorial, Townsville, Australia, 1997
12. “Analyse und Transformation von Gleichheitsbeweisen in einer verteilten Umgebung”, yearly meeting of the GI-Fachgruppe 1.2.1. “Deduktion”, Kaiserslautern, Germany, 1993