

Reactive Systems Group
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Research Interests

- Decision Procedures for the Analysis and Verification of Complex Systems
- Automatic Synthesis of Systems from Formal Specifications
- Synthesis and Verification of Distributed/Concurrent Systems

Education

- 11/2004–01/2010 Doctoral student at Saarland University and Max Planck Institute for Informatics.
Doctoral thesis *Hierarchic Decision Procedures for Verification*.
Thesis advisor: Priv.-Doz. Dr. Viorica Sofronie-Stokkermans.
Dr.-Ing. degree **summa cum laude** (with highest honors).
- 10/1999–11/2004 Student of computer science at Saarland University.
Diploma thesis *Instance Generation Methods for Automated Reasoning*.
Thesis advisors: Prof. Harald Ganzinger and Dr. Uwe Waldmann.

Work Experience Summary

- 09/2014–now Postdoctoral researcher at Saarland University, *Reactive Systems* group.
Since 01/2015: **Principle investigator** of DFG project on *Parameterized Synthesis*.
- 04/2012–08/2014 Postdoctoral researcher at Technische Universität Graz (TU Graz),
Secure and Correct Systems (SCoS) group.
- 10/2012 **Visiting professor** at University of Ljubljana.
- 02/2010–03/2012 Postdoctoral researcher at Ecole Polytechnique Fédérale de Lausanne (EPFL),
Laboratory for Automated Reasoning and Analysis (LARA).
- 11/2004–01/2010 Researcher at the Max Planck Institute for Informatics,
Programming Logics and *Automation of Logics* groups.

Track Record: Highlights

- I have **published** 3 journal articles (including one in the Journal of Automated Reasoning), 14 papers at international conferences (including multiple papers at CAV and TACAS), and 3 workshop papers. Furthermore, I have co-authored a **book** on *Decidability of Parameterized Verification*, published in September 2015 in the series *Synthesis Lectures in Distributed Computing Theory* at Morgan & Claypool publishers.
- I have been **awarded funding** for further research into *Automatic Synthesis of Distributed and Parameterized Systems* by the DFG (2 positions for 3 years, total funding: 474.600 €).
- I am the **main organizer and a co-founder** of the *Reactive Synthesis Competition (SYNTCOMP)*. The first two competitions were held as satellite events of CAV 2014 and CAV 2015, respectively.

Funding Awarded

For further research into *Automatic Synthesis of Distributed and Parameterized Systems*, I have been awarded funding from the German Research Foundation (DFG, project JA 2357/2-1). The DFG will fund the project for 36 months, including my position as PI and one PhD student. **Total funding: 474.600 €.**

Professional Service

Organization Committee Membership

- **Synthesis Competition for Reactive Systems** (associated with CAV 2014, CAV 2015):
I am a co-founder of the *Synthesis Competition for Reactive Systems* (SYNTCOMP), together with Roderick Bloem (TU Graz) and Rüdiger Ehlers (Uni Bremen). I am the main organizer of the competition, my responsibilities included the introduction of a benchmark format, collection of benchmarks, technical setup, execution, and analysis and presentation of results. SYNTCOMP was held for the first time at TU Graz as a satellite event of CAV 2014. The second competition was executed at Saarland University as a satellite event of CAV 2015.
- CAV 2014: Publicity & Proceedings Chair.

Program Committee Membership

- Symposium on Stabilization, Safety, and Security of Distributed Systems (SSS 2015)
- Workshop on Synthesis (SYNT 2014)
- Workshop on Strategies in Rewriting, Proving and Programming (IWS 2012)

Additional Referee Activities

- Journals:** Formal Aspects of Computing, Acta Informatica, Information and Computation, Information Processing Letters, Annals of Mathematics and Artificial Intelligence.
- Conferences:** DISC 2015, SSS 2014, CONCUR 2014, CAV 2014, IJCAR 2014, CSL-LICS 2014, TACAS 2014, FMCAD 2013, CADE 2013, CAV 2013, HVC 2012, CAV 2012, VMCAI 2012, VSTTE 2012, SAS 2011, CADE 2011, VMCAI 2011, ICFEM 2010, IJCAR 2010, POPL 2010, FRODOS 2009, TABLEAUX 2009, IJCAR 2008.

Development of Scientific Software Tools

- PARTY, a tool for synthesis of components for parameterized systems. (presented in [CAV13])
Responsibilities: high-level design and optimizations.
Language: Python.
- *lsynt*, a tool for synthesis of reactive systems from temporal logic specifications. (presented in [VMCAI12])
Responsibilities: complete design & implementation.
Language: OCaml.
- *iLoRe*, an automatic theorem prover that extends SMT solvers. (presented in [CAV09])
Responsibilities: complete design & implementation.
Language: OCaml.
- *FOMC*, a model checker for hybrid systems. (presented in [ATVA07])
Responsibilities: implementing quantifier elimination procedures for flow computation.
Language: C++.

Publications

I have 3 publications in peer-reviewed journals, 14 publications in peer-reviewed conferences, and 2 in peer-reviewed workshops. Another workshop paper as well as a monograph on decidability results in parameterized verification of distributed systems are accepted for publication in 2015, and two additional papers are currently under review (with preprints published on arXiv). Google Scholar reports my h-index as 10, and my i10-index as 12.

Monographs

- [SyntLect15] Roderick Bloem, Swen Jacobs, Ayrat Khalimov, Igor Konnov, Sasha Rubin, Helmut Veith, Josef Widder, *Decidability of Parameterized Verification*. In series: Synthesis Lectures on Distributed Computing Theory. Morgan & Claypool Publishers. <http://www.morganclaypool.com/doi/10.2200/S00658ED1V01Y201508DCT013>

Journal Publications

- [LMCS14] Swen Jacobs and Roderick Bloem, *Parameterized Synthesis*. In Logical Methods in Computer Science, **10**(1:12), pages 1–29, 2014.
- [ENTCS07] Swen Jacobs and Viorica Sofronie-Stokkermans, *Applications of Hierarchical Reasoning in the Verification of Complex Systems*. In Electronic Notes in Theoretical Computer Science **174**/8, pages 39–54, 2007.
- [JAR07] Swen Jacobs and Uwe Waldmann, *Comparing Instance Generation Methods for Automated Reasoning*. In Journal of Automated Reasoning **38**(1-3), pages 57–78, 2007.

Conference Publications

- [TACAS15] Roderick Bloem, Krishnendu Chatterjee, Swen Jacobs and Robert Koenighofer, *Assume-Guarantee Synthesis for Concurrent Reactive Programs with Partial Information*. In TACAS 2015, LNCS 9035, pages 517–532, 2015.
- [VMCAI14] Benjamin Aminof, Swen Jacobs, Ayrat Khalimov and Sasha Rubin, *Parameterized Model Checking of Token-Passing Systems*. In VMCAI 2014, LNCS 8318, pages 262–281, 2014.
- [CAV13] Ayrat Khalimov, Swen Jacobs and Roderick Bloem, *PARTY Parameterized Synthesis of Token Rings*. In CAV 2013, LNCS 8044, pages 928–933, 2013.
- [VMCAI13a] Ayrat Khalimov, Swen Jacobs and Roderick Bloem, *Towards Efficient Parameterized Synthesis*. In VMCAI 2013, LNCS 7737, pages 108–127, 2013.
- [VMCAI13b] Swen Jacobs, Viktor Kuncak and Philippe Suter, *Reductions for Synthesis Procedures*. In VMCAI 2013, LNCS 7737, pages 88–107, 2013.
- [TACAS12] Swen Jacobs and Roderick Bloem, *Parameterized Synthesis*. In TACAS 2012, LNCS 7214, pages 362–376, 2012.
- [VMCAI12] Bernd Finkbeiner and Swen Jacobs, *Lazy Synthesis*. In VMCAI 2012, LNCS 7148, pages 219–234, 2012.
- [VMCAI11] Swen Jacobs and Viktor Kuncak, *Towards Complete Reasoning about Axiomatic Specifications*. In VMCAI 2011, LNCS 6538, pages 278–293.
- [IFM10] Johannes Faber, Carsten Ihlemann, Swen Jacobs and Viorica Sofronie-Stokkermans, *Automatic Verification of Parametric Specifications with Complex Topologies*. In IFM 2010, LNCS 6396, pages 152–167.

- [CAV09] Swen Jacobs, *Incremental Instance Generation in Local Reasoning*. In CAV 2009, LNCS 5643, pages 368–382, 2009.
- [TACAS08] Carsten Ihlemann, Swen Jacobs and Viorica Sofronie-Stokkermans, *On Local Reasoning in Verification*. In TACAS 2008, LNCS 4963, pages 265–281, 2008.
- [ATVA07] Werner Damm, Stefan Disch, Hardi Hungar, Swen Jacobs, Jun Pang, Florian Pigorsch, Christoph Scholl, Uwe Waldmann, and Boris Wirtz, *Exact State Set Representation in the Verification of Linear Hybrid Systems with Large Discrete State Space*. In ATVA 2007, LNCS 4762, pages 425–440, 2007.
- [IFM07] Johannes Faber, Swen Jacobs and Viorica Sofronie-Stokkermans, *Verifying CSP-OZ-DC Specifications with Complex Data Types and Timing Parameters*. In IFM 2007, LNCS 4591, pages 233–252, 2007.
- [TABLEAUX05] Swen Jacobs and Uwe Waldmann, *Comparing Instance Generation Methods for Automated Reasoning*. In TABLEAUX 2005, LNAI 3702, pages 153–168, 2005.

Workshop Publications

- [SYNT15] Swen Jacobs, Roderick Bloem, Romain Brenguier, Robert Könighofer, Guillermo A. Pérez, Jean-François Raskin, Leonid Ryzhyk, Ocan Sankur, Martina Seidl, Leander Tentrup, Adam Walker: *The Second Reactive Synthesis Competition (SYNTCOMP 2015)*. In SYNT 2015, EPTCS, to appear.
- [SYNT14a] Roderick Bloem, Rüdiger Ehlers, Swen Jacobs and Robert Könighofer: *How to Handle Assumptions in Synthesis*. In SYNT 2014, EPTCS 157, pages 34–50, 2014.
- [SYNT14b] Roderick Bloem, Swen Jacobs and Ayrat Khalimov, *Parameterized Synthesis Case Study: AMBA AHB*. In SYNT 2014, EPTCS 157, pages 68–83, 2014.

Theses

- [PhD10] *Hierarchical Decision Procedures for Verification*, PhD thesis, Saarland University, 2010.
- [Diploma04] *Instance Generation Methods for Automated Reasoning*, Diploma thesis, Saarland University, 2004.

Other Publications (Preprints, Technical Reports, Seminar Publications)

- [arXiv15c] Swen Jacobs, Leander Tentrup, Martin Zimmermann, *Distributed and Parametric Synthesis*. arXiv preprint, <http://arxiv.org/abs/1509.05144>, 2015.
- [arXiv15b] Swen Jacobs, Roderick Bloem, Romain Brenguier, Rüdiger Ehlers, Timotheus Hell, Robert Könighofer, Guillermo A. Pérez, Jean-François Raskin, Leonid Ryzhyk, Ocan Sankur, Martina Seidl, Leander Tentrup, Adam Walker, *The First Reactive Synthesis Competition (SYNTCOMP 2014)*. arXiv preprint, <http://arxiv.org/abs/1506.08726>, 2015.
- [arXiv15a] Simon Außerlechner, Swen Jacobs, Ayrat Khalimov, *Tight Cutoffs for Guarded Protocols with Fairness*. arXiv preprint, <http://arxiv.org/abs/1505.03273>, 2015.
- [arXiv14c] Roderick Bloem, Krishnendu Chatterjee, Swen Jacobs, Robert Könighofer, *Assume-Guarantee Synthesis for Concurrent Reactive Programs with Partial Information*. arXiv preprint, <http://arxiv.org/abs/1411.4604>, 2014.
- [arXiv14b] Roderick Bloem, Swen Jacobs, Ayrat Khalimov, *Parameterized Synthesis Case Study: AMBA AHB*. arXiv preprint, <http://arxiv.org/abs/1406.7608>, 2014.

- [arXiv14a] Swen Jacobs, *Extended AIGER Format for Synthesis*. arXiv preprint, <http://arxiv.org/abs/1405.5793>, 2014.
- [arXiv13] Benjamin Aminof, Swen Jacobs, Ayrat Khalimov and Sasha Rubin, *Parameterized Model Checking of Token-Passing Systems*. arXiv preprint, <http://arxiv.org/abs/1311.4425>, 2013.
- [EPFL-TR12] Swen Jacobs, Viktor Kuncak and Philippe Suter, *On Reductions for Synthesis Procedures*. EPFL Technical Report EPFL-REPORT-181031, 2012.
- [AVACS-TR10] Johannes Faber, Carsten Ihlemann, Swen Jacobs and Viorica Sofronie-Stokkermans, *Automatic Verification of Parametric Specifications with Complex Topologies*. AVACS Technical Report No.66, 2010.
- [EPFL-TR10a] Swen Jacobs and Viktor Kuncak, *On Complete Reasoning about Axiomatic Specifications*, EPFL Technical Report EPFL-REPORT-151486, 2010.
- [EPFL-TR10b] Swen Jacobs and Viktor Kuncak, *On Locality of One-Variable Axioms and Piecewise Combinations*. EPFL Technical Report EPFL-REPORT-148180, 2010.
- [CEDAR08] Swen Jacobs, *Incremental Instance Generation in Local Reasoning*. In CEDAR Workshop 2008, informal proceedings, pages 47–62, 2008.
- [Dagstuhl07] Viorica Sofronie-Stokkermans, Carsten Ihlemann and Swen Jacobs, *Local Theory Extensions, Hierarchical Reasoning and Applications to Verification*. Dagstuhl Seminar Proceedings 07401 (Deduction and Decision Procedures), pages 1–22, 2007.
- [PDPAR06] Swen Jacobs and Viorica Sofronie-Stokkermans, *Applications of Hierarchical Reasoning in the Verification of Complex Systems*. In PDPAR'06, informal proceedings, pages 15–26, 2006.
- [Seminar03] Swen Jacobs, *ω -Automata and corresponding Logics*. Seminar: Logical Aspects of XML, Saarland University, 2003.