

# Curriculum Vitae

*Frits Willem Vaandrager*

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## Personal Facts

*FULL NAME:* Frits Willem Vaandrager  
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*BORN:* July 22, 1962, Voorschoten, The Netherlands  
*NATIONALITY:* Dutch  
*MARITAL STATUS:* Married, three children

## Research Interests

Vaandrager's PhD thesis shaped the research field that investigates general formats for **structural operational semantics** (+/- 700 cites, with Groote). During his PhD studies, he obtained several other high impact results on **concurrency theory** (+/- 1400 cites), not included in his thesis, such as Petri net models for process algebras (with Van Glabbeek), an algorithm for branching bisimulation (with Groote), and logical characterizations of branching bisimulation equivalence (with De Nicola). As a postdoctoral

fellow at MIT, his attention shifted to assertional frameworks for the description and analysis of computing systems. At MIT he wrote three influential papers with Lynch (+/- 800 cites, 2nd most cited paper *Information & Computation* 1995) on the classification of forward and backward simulation proof techniques. The collaboration with Lynch was continued after he left MIT. Together with Lynch, Segala (Verona) and Kaynar (CMU), he further developed the highly influential **I/O automata** system modeling framework (15 papers, +/- 1600 cites, most cited paper *Information & Computation* 2003). At Radboud University, he became interested in **model checking of timed automata**. Within the EU AMETIST project (which he coordinated) and other EU projects, he worked with Larsen's team (Aalborg) on various extensions that have been implemented in the Uppaal tool, such as minimal cost reachability, symmetry reduction, parametric and distributed model checking (25 papers, +/- 1200 cites). In part due to these efforts, Uppaal is now routinely used for industrial case studies and has thousands of users, both in academia and industry. He has been and is involved in more than 25 EU and national projects devoted to the **application of formal methods** to areas such as security and network protocols, embedded software, scheduling, performance analysis, and legacy software (+/- 1000 cites). Since 2010, his research has shifted to the **application of automata learning in software engineering**. Initially only few researchers were working on this topic but this is rapidly changing. Vaandrager's team is internationally leading in this new area, with publications in high impact venues (e.g. CONCUR, FM, iFM, CAV, Machine Learning, FMSD, CACM) both on theoretical advances and on applications in areas such as network protocols, banking cards and legacy software. Vaandrager's team collaborates with several other leading researchers, e.g. the teams of Steffen (Dortmund), Jonsson (Uppsala) and Silva (University College London). Vaandrager's team has developed the Tomte tool, one of the leading tools for active learning of register automata.

## Education

- Ph.D. in Computer Science, University of Amsterdam, February 1990. Thesis title: *Algebraic techniques for concurrency and their application*; supervisor: Prof. J.A. Bergstra.
- M.S. in Mathematics with specialization in Computer Science, University of Leiden, June 1985. Thesis title: *Verification of two communi-*

*ation protocols by means of process algebra*; supervisors: Prof. J.A. Bergstra and Prof. A. Ollongren.

## Employment

- Full professor of Informatics for Technical Applications, Institute for Computing and Information Sciences, Radboud University Nijmegen. December 1995 – present.
- Group leader of the project “Concurrency and Real-Time Systems”, Department of Software Technology (Prof. J.W. de Bakker), Centrum voor Wiskunde en Informatica (CWI), Amsterdam. April 1992 – December 1995.
- Part-time “Universitair Hoofddocent” (Associate professor), Programming Research Group, University of Amsterdam. April 1992 – March 1995.
- “Maître de Recherche Associé” (Postdoctoral Associate), Project MEIJE (Dr. G. Berry), Centre de Mathématiques Appliquées (CMA), École Nationale Supérieure des Mines de Paris, Sophia-Antipolis, France. October 1991 – March 1992.
- Postdoctoral Associate, Theory of Distributed Systems research group (Prof. N.A. Lynch), Massachusetts Institute of Technology (MIT), Laboratory for Computer Science, Cambridge, MA, USA. September 1990 – August 1991.
- “Wetenschappelijk Medewerker” (Research Scientist), Department of Software Technology (Prof. J.W. de Bakker), Centrum voor Wiskunde en Informatica (CWI), Amsterdam. July 1985 – June 1990.

## Teaching Experience

- Course on Algorithms and Data Structures, since 2015.
- Course on Model Checking, since 2015.
- Course on Introduction to Robotics (together with Louis Vuurpijl and Pim Haselager), since 2009.

- Course on Software Verification, 2015.
- Research Seminar Software Science, 2015.
- Course on Operating Systems, 2005-2007 and 2012-2015.
- Course on Distributed Systems and Networks, 2013.
- Course on Testing Techniques (together with Jan Tretmans), 2011-2012.
- Course on Analysis of Embedded Systems, from 2006-2014.
- Masterclass on Model Checking for high school students, taught at various schools in (for instance) Nijmegen, Arnhem, Heereveen, and Gouda, since 2007. Based on these masterclasses, I have developed, with Paul Bergervoet, a module of 7 units on model checking with Uppaal for the the on-line teaching method *INFORMATICA-Actief*, which is widely used at Dutch high schools (VWO).
- Course of 8 days for PhD students on Theory and Application of Timed Automata Model Checking at the University of Pisa, May 2011.
- Course on Systems Architecture, 2008-2011.
- Course on Protocol Validation, 1997-2005.
- Course on Operating Systems in 1996, 1997, 1998 and 2000.
- Course on System Modelling for Philips Research, 1999.
- Courses on Process Algebra and Protocol Verification at the University of Amsterdam in 1987, 1989, 1992, 1993 and 1994 (2×).
- BSc and MSc supervisor of dozens students at the Radboud University Nijmegen.
- M.S. supervisor of several students at the University of Amsterdam.

## PhD students

1. Petra van den Bosch (co-promotor: dr.ir. G.J. Tretmans), since August 2015.
2. Ramon Janssen (co-promotor: dr.ir. G.J. Tretmans), since August 2015.
3. Alexis Linard, since September 2015.
4. Joshua Moerman, since February 2015.
5. Paul Fiterău-Broștean, since November 2013.
6. Gaetano Pellegrino (co-promotor: dr.ir. S.E. Verwer), since November 2013.
7. Rick Smetsers (co-promotor: dr.ir. S.E. Verwer), since October 2013.
8. Michele Volpato (co-promotor: dr.ir. G.J. Tretmans), since January 2012.
9. Fides Aarts, *Tomte: Bridging the Gap between Active Learning and Real-World Systems*. Radboud University Nijmegen, October 27, 2014.
10. Freek Verbeek (second promotor: prof.dr. M.C.J.D. van Eekelen; co-promotor: dr J. Schmaltz). *Formal Verification of On-Chip Communication Fabrics*, Radboud University Nijmegen. Radboud University Nijmegen, March 26, 2013.
11. Georgeta Igna. *Performance Analysis of Real-Time Printing Systems using Timed Automata*, Radboud University Nijmegen, January 22, 2013.
12. Faranek Heidarian Dehkordi. *Studies on Verification of Wireless Sensor Networks & Abstraction Learning for System Inference*, Radboud University Nijmegen, July 2012.
13. Jasper Berendsen. *Abstraction, Prices and Probability in Model Checking Timed Automata*, Radboud University Nijmegen, November 2010.

14. Marcel Verhoef (co-promotor: dr J.J.M. Hooman). *Modeling and Validating Distributed Embedded Real-Time Control Systems*, Radboud University Nijmegen, January 2009.
15. A.L. de Groot (co-promotor: dr J.J.M. Hooman). *Practical Automaton Proofs in PVS*, Radboud University Nijmegen, March 2008.
16. Biniam Gebremichael. *Expressiveness of Timed Automata Models*, Radboud University Nijmegen, December 2006.
17. Ling Cheung. *Reconciling Nondeterministic and Probabilistic Choices*, Radboud University Nijmegen, September 2006. (Cum Laude)
18. Martijn Hendriks. *Model Checking Timed Automata: Techniques and Applications*, Radboud University Nijmegen, April 2006.
19. Goran Frehse. *Compositional Verification of Hybrid Systems Using Simulation Relations*, Radboud University Nijmegen, October 2005. Second promotor: Prof.Dr.-Ing. S. Engell, University of Dortmund.
20. M.I.A. Stoelinga. *Alea Jacta Est: Verification of Probabilistic, Real-Time and Parametric Systems*, University of Nijmegen, April 2002.
21. A. Fehnker. *Citius, Vilius, Melius: Guiding and Cost-Optimality in Model Checking of Timed and Hybrid Systems*, University of Nijmegen, April 2002. (Cum Laude)
22. W.O.D. Griffioen. *Studies in Computer Aided Verification*, University of Nijmegen, May 2000.
23. J.M.T. Romijn. *Analysing Industrial Protocols with Formal Methods*, University of Twente, October 1999. First promotor Prof. H. Brinksma, University of Twente.
24. M.S. Klein Gebbinck. *Decomposition of mixed pixels in remote sensing images to improve the area estimation of agricultural fields*, University of Nijmegen, November 1998. Co-promotor dr. Th. Schouten, University of Nijmegen.

25. F.J.M. Panken.  
*Design and performance evaluation of multiple-access protocols for ATM-based passive optical networks*, University of Nijmegen, November 1997.  
Co-promotor dr. C. Blondia, University of Antwerp, Belgium.

## Quality Indicators

1. Google Scholar lists 8049 citations to my papers. My h-index according to scholar is 47 (February 2017).
2. In March 2016, an international committee assessed the research in Computer Science in the Netherlands. Vaandrager's institute (iCIS) received the maximal score for research quality and viability, and received the highest scores of all research institutes in the Netherlands (together with Twente University).
3. Extended University Teaching Qualification (UKO), 2013.
4. In March 2010, an international committee assessed the research in Computer Science in the Netherlands. Vaandrager's group (MBSD) received the maximal score of 5 for quality, relevance, and vitality and feasibility, and a score of 4.5 for the research program and productivity.
5. Mariëlle Stoelinga received the 2008 Professor De Winter prize for the article L. Cheung, M.I.A. Stoelinga and F.W. Vaandrager. A Testing Scenario for Probabilistic Processes. *Journal of the ACM* 54(6), December 2007. The Professor De Winter prize (2500 euro) is awarded for the best journal paper co-authored by a female researcher at the University of Twente.
6. In May 2004, an international committee evaluated the research in Computer Science in the Netherlands. Vaandrager's group (ITA) was the only group in the Netherlands that received the maximal overall score *Excellent*, and the quality of research was judged to be *Very Good*.
7. Best paper award ICALP'03 (Track B).
8. Best paper award FTRTFT'94.

## European Projects

1. DFG/NWO bilateral cooperation project RigorOus dependability analysis using model CheckIng techniques for Stochastic systems (ROCKS). July 2009 - November 2013.
2. EU FP7 project Quantitative System Properties in Model-Driven-Design of Embedded Systems (QUASIMODO), January 2008 - December 2010.
3. Overseas collaborator in the project Formal Methods for the Specification and Verification of Ad Hoc Networks (PROODOS). Department of Computer Science, University of Cyprus (Anna Philippou, Chryssis Georgiou), January 2006 - December 2007.
4. DFG/NWO bilateral cooperation project Validation of Stochastic Systems (VOSS2). January 2005 - December 2007.
5. EU IST Project IST-2001-35304, Advanced Methods for Timed Systems (AMETIST). April 2002 - March 2005. Coordinator. This project has a budget that exceeds 2 M Euro and involves 4 industrial and 7 academic partners.
6. DFG/NWO bilateral cooperation project Validation of Stochastic Systems (VOSS). March 2001 - February 2004.
7. Esprit Project 26270, Verification of Hybrid Systems (VHS). May 1998 - October 2001.
8. HCM Cooperation Network CT930406, Expressiveness of Languages for Concurrency (EXPRESS). January 1994 – December 1997. (Coordinator of this project from January 1994 – January 1996)
9. European Research Action on Verification and Validation Methods for Formal Descriptions (COST Project 247). January 94 – December 1995.
10. ESPRIT Basic Research Action no. 7166, Calculi and Algebras of Concurrency: Extensions, Tools and Applications (CONCUR2). September 1992 – August 1995. (Scientific manager)
11. RACE project no. 2076, Broadband Object-Oriented Service Technology (BOOST). April 1992 – December 1994.



12. RACE project no. 1046, Specification and Programming Environment for Communications Software (SPECS). March 1988 – June 1990, April 1992 – December 1992.
13. ESPRIT Basic Research Action no. 3006, Theories of Concurrency: Unification and Extension (CONCUR). March 1990 – June 1990.
14. ESPRIT project no. 1283, VDM Specification for the Interface of the Portable Common Tool Environment (VIP). November 1986 – December 1988.
15. ESPRIT project no. 432, An Integrated Formal Approach to Industrial Software Development (METEOR). July 1985 – October 1989.

### **National Grants (since 2007)**

1. STW project "Supersizing Model-Based testing (SUMBAT)" (together with J. Tretmans, J. vd Pol and M. Stoelinga). From 2015 onwards.
2. RU Faculty of Science project "On the quality of hypotheses in active automata learning", from February 1, 2015 (together with Bas Terwijn en Alexandra Silva).
3. STW Perspectief project "Robust Design of Cyber Physical Systems (CPS)". 1 PhD student, starting 2015.
4. NWO/EW project 628.001.009 "Learning Extended State Machines for Malware Analysis (LEMMA)" (together with S. Verwer). 2 PhD students, starting end 2013.
5. NWO/EW project 612.001.216 "Active Learning of Security Protocols (ALSeP)". 1 PhD student, starting November 1, 2013.
6. STW project "Integrating Testing And Learning of Interface Automata (ITALIA)" (together with J. Tretmans). 2 PhD students, starting January 2012.
7. NWO Visitor Travel Grants for prof.dr. C. Morgan (040.11.303) and dr. A. McIver (040.11.302), 2012. (15KEuro).

8. KWR project FATs Domino “Automatic test case generation and test execution for software and System-on-Chip platform development in printers and copiers using model based testing (FATs Domino)” (together with J. Tretmans, P. Koopman and Océ). 1 junior researcher for 9 months. From January 2010 - December 2010.
9. NWO/EW project 612.064.811 “Formal Verification of Deadlock Avoidance Mechanisms (FVDAM)” (together with Julien Schmaltz). 1 PhD student. Four years, starting end 2008 - March 2013.
10. NWO/EW project 612.064.610 “Abstraction Refinement for Timed Systems (ARTS)”. 1 PhD student. From January 2008 - December 2011.
11. ESI project Octopus. 1 PhD student from December 2007 until November 2011, plus 1 postdoc for 2 years from the end of 2009 onwards.
12. NWO Focus project Advancing the Real use of Proof Assistants (ARPA). 1 postdoc (together with prof. H. Geuvers). From 1/9/2005 to 1/9/2009.

### **Programme Committees (since 2007)**

1. 24th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2018)
2. 17th International Conference on Runtime Verification (RV 2017)
3. SYNT 2017 (affiliated workshop CAV’17), Heidelberg, Germany, 2017.
4. 13th International Conference on Integrated Formal Methods, September 20-22, 2017, Turin, Italy.
5. Second International Workshop on Models for Formal Analysis of Real Systems (MARS), April 2017, Uppsala, Sweden.
6. 11th International Conference on Language and Automata Theory and Applications (LATA 2017), Umea, Sweden, March 6-10, 2017.
7. Jury ING Testing Thesis Award, November 18, 2016, Amsterdam.
8. 13th International Conference on Formal Aspects of Component Software (FACS’16), October 19-21, 2016 at Besancon, France.

9. 6th International Workshop on Design, Modeling and Evaluation of Cyber Physical Systems (CyPhy'16), Pittsburgh, USA, October 6, 2016.
10. 13th International Conference on Grammatical Inference (ICGI'16), Delft, October 5-7, 2016.
11. 10th International Conference on Language and Automata Theory and Applications (LATA'16), Prague, March 14-18, 2016.
12. 13th International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS'15), Madrid, Spain, 2-4 September, 2015.
13. 9th International Conference on Language and Automata Theory and Applications (LATA 2015), Nice, France, March 2-6, 2015.
14. 12th International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS 2014), 8-10 September 2014, Florence, Italy.
15. 20th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2014), 5-13 April 2014, Grenoble, France.
16. 17th International Conference On Principles Of Distributed Systems (OPODIS 2013), December 16-18, 2013, Nice, France.
17. 24th International Conference on Concurrency Theory (CONCUR 2013), Buenos Aires, Argentina, 26-31 August 2013.
18. Formal Modeling and Analysis of Timed Systems (FORMATS 2012), London, UK, at Imperial College London, 18-20 September 2012.
19. 10th School on Modelling and Verifying parallel Processes (MOVEP'12), Marseilles, France, December 3-7, 2012.
20. 15th ACM Conference on Languages, Compilers, Tools & Theory for Embedded Systems (LCTES 2012), June 12-13, Beijing, China.
21. 6th International Conference on Language and Automata Theory and Applications (LATA 2012), March 5-9, 2012, A Coruña, Spain.

22. 13th ACM International Conference on Hybrid Systems: Computation and Control (HSCC'10), in conjunction with CPSWEEK, April 12-16, 2010, Stockholm.
23. Doctoral Symposium of FM'09, Eindhoven, The Netherlands, Friday November 6, 2009.
24. 7th International Conference on Formal Modelling and Analysis of Timed Systems (FORMATS'09), Technical University of Budapest, 13th-16th September, 2009. (PC co-chair, together with Joël Ouaknine).
25. Program Board for Computer Science of the Lorentz Center, Leiden, 2003-2009.
26. Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2009), 22-29 March 2009, York, UK.
27. 29th IEEE Real-Time Systems Symposium (RTSS 2008), Barcelona, Spain, November 30 - December 3, 2008.
28. 6th International Conference on Formal Modelling and Analysis of Timed Systems (FORMATS'08), Saint-Malo, France, September 15-17, 2008.
29. Jury ICTRegie Award 2008.
30. Scientific coordinator of Lorentz Center workshop "Two decades of probabilistic verification – Reflections and perspectives", Leiden, November 12-16, 2007
31. 5th International Conference on Formal Modelling and Analysis of Timed Systems (FORMATS'07), Salzburg, Austria, October 3-5, 2007.
32. 7th ACM International Conference on Embedded Software (EMSOFT 2007), Salzburg, Austria, Sept 30 - Oct 5, 2007.
33. Track B "Logic, Semantics, and Theory of Programming" of the 34th International Colloquium on Automata, Languages and Programming (ICALP 2007), Wroclaw, Poland, July 9-14, 2007.
34. 19th International Conference on Computer Aided Verification (CAV 2007), Berlin, Germany, July 3-7, 2007.

## Membership of Professional Organizations

- Member IPA, Dutch Graduate School Institute for Programming research and Algorithmics.
- Member Nederlandse Vereniging voor Theoretische Informatica (NVTI, Society for Theoretical Computer Science in the Netherlands).
- Member European Association for Theoretical Computer Science (EATCS).
- Member Association for Computing Machinery (ACM).
- Member Institute of Electrical and Electronics Engineers (IEEE).

## Other Professional Activities (since 2007)

- Editor *Software Tools for Technology Transfer (STTT)*, since 2017.
- Editor *Logical Methods in Computer Science (LMCS)*, since 2004.
- Editor *Information and Computation*, since 2003.
- Vice Dean of Research, Faculty of Science, Radboud University Nijmegen, since October 2014.
- Chair Steering Group Research Data Management, Radboud University Nijmegen, since August 2016.
- Columnist for Voxweb, independent magazine of the Radboud University Nijmegen, <http://www.voxweb.nl/author/frits>, since September 2012.
- Member International Advisory Panel of the Johann Bernoulli Institute, University of Groningen, since 2012.
- Member Advisory Panel, Faculty of Mathematics and Computer Science, Technical University of Eindhoven, since 2014.
- Coordinator Software Science master track Radboud University Nijmegen, September 2013 - September 2016.
- Member Steering Group Research Data Management, Radboud University Nijmegen, September 2013 - January 2016.

- Member “College van Beroep voor de Examens van de Radboud Universiteit Nijmegen”, 2000 - 2015.
- Reviewer FP7-ICT ADVANCE (287563) Advanced Design and Verification Environment for Cyber-physical System Engineering, 2012-2015.
- Director of Studies Computing and Information Sciences, Radboud University Nijmegen, March 2013 - December 2014.
- Member Search Committee for Chair in Software Technology at the University of Utrecht, 2013/2014.
- Member evaluation committee NWO EW TOP grants, 2013.
- Member evaluation committee STW Perspectief, 2011 and 2013.
- Member program board Honours Programme Faculty of Science Radboud University, August 2008 - August 2013.
- Member midterm research evaluation committee Computer Science departments 3TU, period 2009-2012.
- Member Gebiedsbestuur Exacte Wetenschappen NWO, (committee within the Netherlands Organisation for Scientific Research responsible for mathematics, computing science and astronomy), September 2006 - December 2012.
- Reviewer EU IST project STREP 215543 COMponent-Based Embedded Systems design Techniques (COMBEST), 2008-2011.
- External expert for assessing candidates for Chair in Embedded Systems, Uppsala University, Sweden, Fall 2008.
- Coordinator team for attracting new students for Computer/Information Sciences at the RU, from September 2007 - Februari 2012.
- Member Review Panel DFG Transregional Collaborative Research Centre Sonderforschungsbereich/Transregio 14 “AVACS - Automatic Verification and Analysis of Complex Systems”, September 2007.

## Dissertations (since 2007)

1. External examiner at the Ph.D. defense of Sofia Cassel, *Learning Component Behavior from Tests: Theory and Algorithms for Automata with Data*, University of Uppsala, Sweden, December 2015
2. Chair manuscript committee Ph.D. thesis Robbert Krebbers, *The C standard formalized in Coq*, Radboud University Nijmegen, December 2015.
3. “Zweiter Gutachter” Ph.D. thesis Malte Isberner, *Foundations of Active Automata Learning: An Algorithmic Perspective*, Technische Universität Dortmund, Germany, September 2015.
4. Chair manuscript committee Ph.D. thesis Rody Kersten, *Software Analysis Methods for Resource-Sensitive Systems*, Radboud University Nijmegen, September 2015.
5. Chair manuscript committee Ph.D. thesis Joeri de Ruiter, *Lessons learned in the analysis of the EMV and TLS security protocols*, Radboud University Nijmegen, 2015.
6. “Zweiter Gutachter” Ph.D. thesis Christian Schoppmeyer, *Reactive Scheduling Using Timed Automata Models and Integration with Sequential Control Logic*, Technische Universität Dortmund, Germany, June 2015.
7. Member promotion committee Ph.D. thesis Ken Madlener, *Formally Verified Modular Semantics*, Radboud University Nijmegen, October 9, 2014.
8. Member promotion committee Ph.D. thesis Georgiana Caltais, *Coalgebraic Tools for Bisimilarity and Decorated Trace Semantics*, Radboud University Nijmegen, December 16, 2013.
9. Member promotion committee Ph.D. thesis Jeroen Keiren, *Advanced Reduction Techniques for Model Checking*, Eindhoven University of Technology, September 17, 2013.
10. Member jury Ph.D. thesis Abdeldjalil Boudjadar, *Compositional Semantics and Refinement of Timed Systems – Application to Uppaal Timed Automata and to the Fiacre Language*, Université de Toulouse, France, December 4, 2012.

11. Member promotion committee Ph.D. thesis Thomas van Noort, *Dynamic Typing in Type-Driven Programming*, Radboud University Nijmegen, May 8, 2012.
12. Chair manuscript committee Ph.D. thesis Miguel E. Andrés, *Information Leakage in Probabilistic and Nondeterministic Systems*, Radboud University Nijmegen, 2011.
13. Member promotion committee Marijn Jongerden, *Model-based energy analysis of battery powered systems*, University of Twente, December 10, 2010.
14. Chair manuscript committee Ph.D. thesis Jan Martin Jansen, *Functional Web Applications — Implementation and Use of Client Side Interpreters*, Radboud University Nijmegen, July 2010.
15. Member promotion committee Gianluigi Folino, *High Performance Data Mining using Bio-inspired Techniques*, Radboud University Nijmegen, March 2010.
16. Member promotion committee Sicco Verwer, *Efficient identification of Timed Automata — Theory and Practice*, Technische Universiteit Delft, March 2, 2010.
17. Member promotion committee Tingting Han, *Diagnosis, Synthesis and Analysis of Probabilistic Models*, University of Twente, September 25, 2009.
18. Opposition at Ph.D. defense Joachim van den Berg, *Reasoning about Java programs in PVS using JML*, Radboud University Nijmegen, July 2009.
19. Opposition at Ph.D. defense Sietse Overbeek, *Bridging Supply and Demand for Knowledge Intensive Tasks Based on Knowledge, Cognition, and Quality*, Radboud University Nijmegen, April 2009.
20. Opposition at Ph.D. defense Ichiro Hasuo, *Tracing Anonymity with Coalgebras*, Radboud University Nijmegen, March 2008.
21. Chair manuscript committee Ph.D. thesis Arjen Hommersom, *On the Application of Formal Methods to Clinical Guidelines, an Artificial Intelligence Perspective*, Radboud University Nijmegen, 2008.



22. Chair manuscript committee Ph.D. thesis Wolter Pieters, *La Volonté Machinale — Understanding the Electronic Voting Controversy*, Radboud University Nijmegen, 2008.
23. Opposition at Ph.D. defense Arjan van Weelden, *Putting Types to Good Use*, Radboud University Nijmegen, October 2007.
24. External opponent at Ph.D. defense Jacob Illum Rasmussen, *How Do You Measure Up? Quantitative Analysis of Real-Time Systems*, University of Aalborg, Denmark, June 2007.

### **Invited Lectures (since 2007)**

1. *Active Learning of Automata*, 3TU.BSR winter school on Big Software on the Run: Where Software meets Data, October 23-28, 2016, Ede.
2. *Refactoring of Legacy Software Using Model Learning and Equivalence Checking*, TNO-ESI Symposium, 19 April, 2016, Eindhoven.
3. *Inference of State Machines*, Keynote lecture at 2nd Software Engineering in The Netherlands” (SEN) symposium, January 21, 2016, CWI, Amsterdam.
4. *Recreational formal methods: Designing vacuum cleaning trajectories using model checkers, constraint solvers and proof assistants*, Dutch Model Checking Day, May 9, 2014, University of Twente.
5. *Inference of State Machines*, Johann Bernoulli Colloquium, March 25, 2014, University of Groningen.
6. *Inference of State Machines*, December 19, 2013, ETH Zurich, Switzerland.
7. *Inference of State Machines*, Series of lectures at the 12th Estonian Summer School on Computer and Systems Science (ESSCaSS 2013), August 18-22, 2013, Voore Guesthouse, Estonia.
8. *Modeling Task Systems Using Parameterized Partial Orders*, Workshop 25 Years of Combining Compositionality and Concurrency (WS25CCC), August 6-9, 2013, Königswinter, Germany.

9. *Active Learning of Extended Finite State Machines*, Keynote lecture at the 23rd IFIP Int. Conference on Testing Software and Systems (ICTSS'12), November 19-21, 2012, Aalborg, Denmark.
10. *From Model Checking to Model Learning: Two Basic Techniques in Model-Based Development of Embedded Systems*, Keynote lecture at the ESI Symposium 2012, Eindhoven, March 22, 2012.
11. *Learning I/O Automata*, Dutch Model Checking Day 2010, University of Eindhoven, July 2010.