Patrick Bahr

Curriculum Vitæ

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Education

Nov. 2009 – Oct. 2012 **PhD in Computer Science**, *University of Copenhagen*, Denmark
- thesis title: *Modular Implementation of Programming Languages and a Partial-Order Approach to Infinitary Rewriting*
- adviser: Fritz Henglein

Oct. 2008 – Sep. 2009 **MSc in Computational Logic**, *Vienna University of Technology*, Austria
- thesis title: *Infinitary Rewriting Systems – Theory and Applications*
- adviser: Bernhard Gramlich
- grade point average: 1.0 (on a scale from 1.0 to 5.0)
- passed with distinction

Oct. 2007 – Oct. 2009 **MSc in Computational Logic**, *Dresden University of Technology*, Germany
- Double degree program in conjunction with the Vienna University of Technology.
- grade point average: 1.0 (on a scale from 1.0 to 5.0)
- passed with distinction

Oct. 2004 – Jan. 2008 **BSc in Computer Science**, *Dresden University of Technology*, Germany
- thesis title: *An Executable Rewriting Logic Semantics for Concurrent Haskell*
- adviser: Christel Baier
- grade point average: 1.0 (on a scale from 1.0 to 5.0)
- passed with distinction

Research Experience

Aug. 2019 – Present **Associate Professor**, *IT University of Copenhagen*, Copenhagen, Denmark (Programming, Logic and Semantics Research Group)

Aug. 2016 – Jul. 2019 **Assistant Professor**, *IT University of Copenhagen*, Copenhagen, Denmark (Programming, Logic and Semantics Research Group)

Aug. 2015 – Jul. 2016 **Postdoctoral Fellow**, *IT University of Copenhagen*, Copenhagen, Denmark (Programming, Logic and Semantics Research Group)
Research on guarded recursion and type theory under the guidance of Rasmus Møgelberg

Nov. 2012 – Jul. 2015 **Postdoctoral Fellow**, *University of Copenhagen*, Copenhagen, Denmark
(Algorithms and Programming Languages Group)

- May 2013 - July 2015: research on the project "Efficient Programming Language Development and Evolution through Modularity"
- major research topics:
  - modularity in programming languages design and implementation
  - domain-specific languages for financial contracts
  - certified compiler implementations

Jan. 2014 – Jun. 2014 **Visiting Researcher**, *Utrecht University*, Utrecht, The Netherlands
(Software Technology Group)
Research on modular attribute grammars, recursion schemes on graphs, and type systems (in collaboration with Doaitse Swierstra, Alejandro Serrano, and Jurriaan Hage)

May 2013 – Nov. 2013 **Visiting Researcher**, *University of Nottingham*, Nottingham, UK
(Functional Programming Laboratory)
Research on modular compiler construction, calculation of compilers, and recursion schemes on graphs (in collaboration with Graham Hutton and Laurence Day).

Nov. 2009 – Oct. 2012 **PhD Fellow**, *University of Copenhagen*, Copenhagen, Denmark
(Algorithms and Programming Languages Group)

- research on the *3gERP* project ("3rd Generation Enterprise Resource Planning Systems")
- major research topics:
  - design and implementation of domain-specific languages for enterprise resource planning systems
  - automatic incrementalisation of functional programs
  - properties of term and term graph rewrite systems

Feb. 2012 – May 2012 **Visiting Researcher**, *Utrecht University*, Utrecht, The Netherlands
(Theoretical Philosophy Group)
Research on infinitary rewriting, higher-order rewriting and optimal sharing (in collaboration with Vincent van Oostrom and Clemens Grabmayer).

Aug. 2008 – Oct. 2008 **Visiting Researcher**, *NICTA Neville Roach Laboratory*, Sydney, Australia
(Software Systems Research Group)
Developing a translation from Haskell into Isabelle/HOL for the l4.verified project (headed by Gerwin Klein)

Grants & Scholarships

- Individual postdoc grant awarded from *The Danish Council For Independent Research — Technology And Production Sciences* over DKK 2.1 Mio for the project "Efficient Programming Language Development and Evolution through Modularity" running from May 2013 until April 2015.
- SOKRATES/ERASMUS scholarship for MSc studies at Vienna University of Technology from Oct. 2008 till Sep. 2009.
- Erasmus Mundus (Action 3) scholarship for research project at NICTA from Aug. 2008 till Oct. 2008.

Awards & Invited Talks

- Invited talk at the 6th International Workshop on Computing with Terms and Graphs 2011: *From Infinitary Term Rewriting to Cyclic Term Graph Rewriting and back*
- Award for the best contribution to the 21st International Conference on Rewriting Techniques and Applications 2010 for the two papers *Abstract Models of Transfinite Reductions* and *Partial Order Infinitary Term Rewriting and Böhm Trees*
- Award for paper of the year 2011 of the Department of Computer Science at the University of Copenhagen for the paper *Partial Order Infinitary Term Rewriting and Böhm Trees*

Academic Refereeing

Service on Program Committees

- ACM SIGPLAN Workshop on Generic Programming (WGP) 2015 (co-chair)
- International Workshop on Meta Models for Process Languages (MeMo) 2014
- Workshop on Infinitary Rewriting (WIR) 2013
- International Workshop on Computing with Terms and Graphs (TERMGRAPH) 2013

Refereeing for Journals

- Acta Informatica
- Higher-Order and Symbolic Computation

Refereeing for Conferences and Workshops

- Conference on Programming Language Design and Implementation (PLDI) 2010
- International Conference on Rewriting Techniques and Applications (RTA) 2010, 2011, 2012, 2014
- International Conference on Functional Programming (ICFP) 2010, 2013
- Haskell Symposium 2010, 2013
- Workshop on Types in Language Design and Implementation (TLDI) 2011
- International Conference on Foundations of Software Science and Computation Structures (FoSSaCS) 2012

Teaching Experience

University of Copenhagen

- Co-teacher for the following courses:
  - lecture on *Advanced Programming* (fall 2010)
  - seminar on *Topics in Programming Languages* (spring 2010)
- Teaching assistant for the lecture *Datalogiens Videnskabsteori* [Philosophy of Computer Science] (fall 2010, 2011, 2012)
- Supervisor for several student projects (teams and individuals).

Dresden University of Technology

- Teacher for repetition classes for Computational Logic students.
- Instructor for the following lectures:
  - *Algorithmen und Datenstrukturen* [Algorithms and Data Structures] (fall 2005)
  - *Programmierung* [Theory of Programming] (spring 2006)
  - *Logik I* [Logic I] (fall 2006, 2007)
  - *Logik II* [Logic II] (spring 2008)
  - *Grundlagen der Theoretischen Informatik I* [Foundations of Theoretical Computer Science I] (spring 2007)
  - *Grundlagen der Theoretischen Informatik II* [Foundations of Theoretical Computer Science II] (fall 2008)
- Supervisor for project groups (spring 2007)

Working Experience

Sep. 2006 – Aug. 2007 **Programmer**, *pcvisit Software AG*, Dresden, Germany
Development of a graphical debugging tool.

2004 – 2008 **Programmer**, *G.WIND*, Kläden, Germany
Building a web site; Implementation of a mobile monitoring software for wind turbines.

References

Prof. Fritz Henglein
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Prof. Graham Hutton
School of Computer Science
University of Nottingham
Jubilee Campus, Wollaton Road
Nottingham NG8 1BB
United Kingdom
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Personal Information

Date of birth 19th March, 1985
Place of birth Germany
Citizenship Germany

Languages

German native
English fluent
Danish professional working proficiency

Publications

Journals

[1] Patrick Bahr and Graham Hutton. *Calculating Compilers for Concurrency*. Proc. ACM Program. Lang., 7(ICFP), 2023.

[2] Patrick Bahr and Rasmus Ejlers Møgelberg. *Asynchronous Modal FRP*. Proc. ACM Program. Lang., 7(ICFP), 2023.

[3] Patrick Bahr. *Modal FRP for all: Functional reactive programming without space leaks in Haskell*. Journal of Functional Programming, 32(e15), 2022.

[4] Patrick Bahr and Graham Hutton. *Monadic Compiler Calculation (Functional Pearl)*. Proc. ACM Program. Lang., 6(ICFP), 2022.

[5] Patrick Bahr, Christian Uldal Graulund and Rasmus Ejlers Møgelberg. *Diamonds Are Not Forever: Liveness in Reactive Programming with Guarded Recursion*. Proc. ACM Program. Lang., 5(POPL), 2021.

[6] Patrick Bahr and Graham Hutton. *Calculating Correct Compilers II: Return of the Register Machines*. Journal of Functional Programming, 30(e25), 2020.

[7] Patrick Bahr, Christian Uldal Graulund and Rasmus Ejlers Møgelberg. *Simply RaTT: A Fitch-style Modal Calculus for Reactive Programming Without Space Leaks*. Proc. ACM Program. Lang., 3(ICFP), p. 109:1-109:27, 2019.

[8] Patrick Bahr. *Convergence in Infinitary Term Graph Rewriting Systems is Simple*. Mathematical Structures in Computer Science, p. 1–52, 2018.

[9] Graham Hutton and Patrick Bahr. *Compiling a 50-year journey*. Journal of Functional Programming, 27, 2017.

[10] Patrick Bahr and Emil Axelsson. *Generalising tree traversals and tree transformations to DAGs: Exploiting sharing without the pain* . Science of Computer Programming, 137, p. 63 - 97, 2017.

[11] Patrick Bahr and Graham Hutton. *Calculating correct compilers*. Journal of Functional Programming, 25, 2015.

[12] Patrick Bahr. *Partial Order Infinitary Term Rewriting*. Logical Methods in Computer Science, 10(2), 2014.

[13] Patrick Bahr. *Modes of Convergence for Term Graph Rewriting*. Logical Methods in Computer Science, 8(2), 2012.

Conferences and Symposia

[14] Patrick Bahr, Emil Houlborg and Gregers Thomas Skat Rørdam. *Asynchronous Reactive Programming with Modal Types in Haskell*. Practical Aspects of Declarative Languages, p. 18-36, 2024.

[15] Patrick Bahr. *Strict Ideal Completions of the Lambda Calculus*. 3rd International Conference on Formal Structures for Computation and Deduction (FSCD 2018), p. 8:1-8:16, 2018.

[16] Patrick Bahr. *Böhm Reduction in Infinitary Term Graph Rewriting Systems*. 2nd International Conference on Formal Structures for Computation and Deduction (FSCD 2017), p. 8:1-8:20, 2017.

[17] Patrick Bahr, Hans Bugge Grathwohl and Rasmus Ejlers Møgelberg. *The Clocks Are Ticking: No More Delays!*. 32nd Annual ACM/IEEE Symposium on Logic in Computer Science (LICS), 2017.

[18] Patrick Bahr, Jost Berthold and Martin Elsman. *Certified Symbolic Management of Financial Multi-party Contracts*. Proceedings of the 20th ACM SIGPLAN International Conference on Functional Programming, p. 315-327, 2015.

[19] Alejandro Serrano, Jurriaan Hage and Patrick Bahr. *Type Families with Class, Type Classes with Family*. Proceedings of the 8th ACM SIGPLAN Symposium on Haskell, p. 129-140, 2015.

[20] Patrick Bahr. *Calculating Certified Compilers for Non-deterministic Languages*. Mathematics of Program Construction, p. 159-186, 2015.

[21] Patrick Bahr and Emil Axelsson. *Generalising Tree Traversals to DAGs: Exploiting Sharing without the Pain*. Proceedings of the 2015 Workshop on Partial Evaluation and Program Manipulation, p. 27-38, 2015.

[22] Jesper Andersen, Patrick Bahr, Fritz Henglein and Tom Hvitved. *Domain-Specific Languages for Enterprise Systems*. Leveraging Applications of Formal Methods, Verification and Validation. Technologies for Mastering Change, p. 73-95, 2014.

[23] Patrick Bahr. *Proving Correctness of Compilers Using Structured Graphs*. Functional and Logic Programming, p. 221-237, 2014.

[24] Patrick Bahr. *Modular Tree Automata*. Mathematics of Program Construction, p. 263-299, 2012.

[25] Patrick Bahr. *Infinitary Term Graph Rewriting is Simple, Sound and Complete*. 23rd International Conference on Rewriting Techniques and Applications (RTA'12), p. 69-84, 2012.

[26] Patrick Bahr. *Modes of Convergence for Term Graph Rewriting*. 22nd International Conference on Rewriting Techniques and Applications (RTA'11), p. 139-154, 2011.

[27] Patrick Bahr. *Partial Order Infinitary Term Rewriting and Böhm Trees*. Proceedings of the 21st International Conference on Rewriting Techniques and Applications, p. 67-84, 2010.

[28] Patrick Bahr. *Abstract Models of Transfinite Reductions*. Proceedings of the 21st International Conference on Rewriting Techniques and Applications, p. 49-66, 2010.

Workshops

[29] Patrick Bahr. *Composing and Decomposing Data Types: A Closed Type Families Implementation of Data Types à La Carte*. Proceedings of the 10th ACM SIGPLAN Workshop on Generic Programming, p. 71-82, 2014.

[30] Patrick Bahr and Laurence E. Day. *Programming macro tree transducers*. Proceedings of the 9th ACM SIGPLAN Workshop on Generic Programming, p. 61-72, 2013.

[31] Patrick Bahr. *Convergence in Infinitary Term Graph Rewriting Systems is Simple (Extended Abstract)*. Proceedings 7th International Workshop on Computing with Terms and Graphs, p. 17-28, 2013.

[32] Patrick Bahr and Tom Hvitved. *Parametric Compositional Data Types*. Proceedings Fourth Workshop on Mathematically Structured Functional Programming, p. 3-24, 2012.

[33] Patrick Bahr and Tom Hvitved. *Compositional data types*. Proceedings of the seventh ACM SIGPLAN workshop on Generic programming, p. 83-94, 2011.

Lightly Refereed Workshops and Conferences

[34] Patrick Bahr, Bassel Mannaa and Rasmus Ejlers Møgelberg. *What makes guarded types tick?*. Programming And Reasoning on Infinite Structures, 2018.

[35] Patrick Bahr, Jost Berthold and Martin Elsman. *Towards Certified Management of Financial Contracts*. Proceedings of the 26th Nordic Workshop on Programming Theory, NWPT '14, 2014.

[36] Laurence E. Day and Patrick Bahr. *Pick'n'Fix: Capturing Control Flow in Modular Compilers*. TFP '14 pre-proceedings, 2014.

[37] Patrick Bahr. *Evaluation à la Carte: Non-Strict Evaluation via Compositional Data Types*. Proceedings of the 23rd Nordic Workshop on Programming Theory, p. 38-40, 2011.

[38] Patrick Bahr. *A Functional Language for Specifying Business Reports*. Proceedings of the 23rd Nordic Workshop on Programming Theory, p. 24-26, 2011.

[39] Patrick Bahr. *Compositional Data Types - A Report from the Field*. Proceedings of the 4th DIKU-IST Joint Workshop on Foundations of Software, 2011.

Book Chapter

[40] Graham Hutton and Patrick Bahr. *A List of Successes That Can Change the World: Essays Dedicated to Philip Wadler on the Occasion of His 60th Birthday*. A List of Successes That Can Change the World: Essays Dedicated to Philip Wadler on the Occasion of His 60th Birthday

To Appear

[41] Patrick Bahr and Graham Hutton. *Beyond Trees: Calculating Graph-Based Compilers*. ICFP 2024, to appear.

Technical Reports

[42] Tom Hvitved, Patrick Bahr and Jesper Andersen. *Domain-Specific Languages for Enterprise Systems*. Technical Report, Department of Computer Science, University of Copenhagen, 2011.

[43] Patrick Bahr. *Infinitary Term Graph Rewriting*. Technical Report, University of Copenhagen, 2011.

[44] Patrick Bahr. *Implementation of a Pragmatic Translation from Haskell into Isabelle/HOL*. Technical Report, NICTA, 2008.

Theses

[45] Patrick Bahr. *Modular Implementation of Programming Languages and a Partial-Order Approach to Infinitary Rewriting*. Ph.D. Dissertation, Department of Computer Science, University of Copenhagen, 2012.

[46] Patrick Bahr. *Infinitary Rewriting - Theory and Applications*. Master's Thesis, Vienna University of Technology, 2009.

[47] Patrick Bahr. *An Executable Rewriting Logic Semantics for Concurrent Haskell*. Bachelor's Thesis, Dresden University of Technology, 2007.