

# Patrick Bahr

## Curriculum Vitæ

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### Education

- Nov. 2009 – **PhD in Computer Science**, *University of Copenhagen*, Denmark.  
Oct. 2012
  - thesis title: *Modular Implementation of Programming Languages and a Partial-Order Approach to Infinitary Rewriting*
  - adviser: Fritz Henglein
- Oct. 2008 – **MSc in Computational Logic**, *Vienna University of Technology*, Austria.  
Sep. 2009
  - 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 – **MSc in Computational Logic**, *Dresden University of Technology*, Germany.  
Oct. 2009
  - 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 – **BSc in Computer Science**, *Dresden University of Technology*, Germany.  
Jan. 2008
  - 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 – **Associate Professor**, *IT University of Copenhagen*, Copenhagen, Denmark.  
Present (Programming, Logic and Semantics Research Group)
- Aug. 2016 – **Assistant Professor**, *IT University of Copenhagen*, Copenhagen, Denmark.  
Jul. 2019 (Programming, Logic and Semantics Research Group)
- Aug. 2015 – **Postdoctoral Fellow**, *IT University of Copenhagen*, Copenhagen, Denmark.  
Jul. 2016 (Programming, Logic and Semantics Research Group)  
Research on guarded recursion and type theory under the guidance of Rasmus Møgelberg

- Nov. 2012 – **Postdoctoral Fellow**, *University of Copenhagen*, Copenhagen, Denmark.  
 Jul. 2015 (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 – **Visiting Researcher**, *Utrecht University*, Utrecht, The Netherlands.  
 Jun. 2014 (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 – **Visiting Researcher**, *University of Nottingham*, Nottingham, UK.  
 Nov. 2013 (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 – **PhD Fellow**, *University of Copenhagen*, Copenhagen, Denmark.  
 Oct. 2012 (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 – **Visiting Researcher**, *Utrecht University*, Utrecht, The Netherlands.  
 May 2012 (Theoretical Philosophy Group)  
 Research on infinitary rewriting, higher-order rewriting and optimal sharing (in collaboration with Vincent van Oostrom and Clemens Grabmayer).
- Aug. 2008 – **Visiting Researcher**, *NICTA Neville Roach Laboratory*, Sydney, Australia.  
 Oct. 2008 (Software Systems Research Group)  
 Developing a translation from Haskell into Isabelle/HOL for the *I4.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)

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## Working Experience

- Sep. 2006 – **Programmer**, *pcvisit Software AG*, Dresden, Germany.  
Aug. 2007 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.

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## References

### Prof. Fritz Henglein

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University of Copenhagen  
Universitetsparken 5  
2100 Copenhagen  
Denmark  
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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

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## Languages

- German native  
English fluent  
Danish professional working proficiency

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## Publications

### Journals

- [1] Patrick Bahr and Graham Hutton. *Calculating Correct Compilers II: Return of the Register Machines*. *Journal of Functional Programming*, 30(e25), 2020.
- [2] 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.
- [3] Patrick Bahr. *Convergence in Infinitary Term Graph Rewriting Systems is Simple*. *Mathematical Structures in Computer Science*, p. 1–52, 2018.
- [4] Graham Hutton and Patrick Bahr. *Compiling a 50-year journey*. *Journal of Functional Programming*, 27, 2017.
- [5] 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.

- [6] Patrick Bahr and Graham Hutton. *Calculating correct compilers*. Journal of Functional Programming, 25, 2015.
- [7] Patrick Bahr. *Partial Order Infinitary Term Rewriting*. Logical Methods in Computer Science, 10(2), 2014.
- [8] Patrick Bahr. *Modes of Convergence for Term Graph Rewriting*. Logical Methods in Computer Science, 8(2), 2012.

## Conferences and Symposia

- [9] 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.
- [10] 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.
- [11] 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.
- [12] 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.
- [13] 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.
- [14] Patrick Bahr. *Calculating Certified Compilers for Non-deterministic Languages*. Mathematics of Program Construction, p. 159-186, 2015.
- [15] 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.
- [16] 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.
- [17] Patrick Bahr. *Proving Correctness of Compilers Using Structured Graphs*. Functional and Logic Programming, p. 221-237, 2014.
- [18] Patrick Bahr. *Modular Tree Automata*. Mathematics of Program Construction, p. 263-299, 2012.

- [19] 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.
- [20] Patrick Bahr. *Modes of Convergence for Term Graph Rewriting*. 22nd International Conference on Rewriting Techniques and Applications (RTA'11), p. 139-154, 2011.
- [21] 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.
- [22] Patrick Bahr. *Abstract Models of Transfinite Reductions*. Proceedings of the 21st International Conference on Rewriting Techniques and Applications, p. 49-66, 2010.

### Workshops

- [23] 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.
- [24] Patrick Bahr and Laurence E. Day. *Programming macro tree transducers*. Proceedings of the 9th ACM SIGPLAN Workshop on Generic Programming, p. 61-72, 2013.
- [25] 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.
- [26] Patrick Bahr and Tom Hvitved. *Parametric Compositional Data Types*. Proceedings Fourth Workshop on Mathematically Structured Functional Programming, p. 3-24, 2012.
- [27] 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

- [28] Patrick Bahr, Bassel Manna and Rasmus Ejlers Møgelberg. *What makes guarded types tick?*. Programming And Reasoning on Infinite Structures, 2018.
- [29] 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.
- [30] Laurence E. Day and Patrick Bahr. *Pick'n'Fix: Capturing Control Flow in Modular Compilers*. TFP '14 pre-proceedings, 2014.
- [31] 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.

- [32] Patrick Bahr. *A Functional Language for Specifying Business Reports*. Proceedings of the 23rd Nordic Workshop on Programming Theory, p. 24-26, 2011.
- [33] 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

- [34] 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

### Under Peer Review

- [35] Patrick Bahr, Christian Uldal Graulund and Rasmus Ejlers Møgelberg. *Diamonds are not Forever: Liveness in Reactive Programming with Guarded Recursion*. Submitted to POPL 2021.
- [36] Patrick Bahr. *Modal FRP For All: Functional Reactive Programming Without Space Leaks in Haskell*. Submitted to POPL 2021.

### Technical Reports

- [37] Tom Hvitved, Patrick Bahr and Jesper Andersen. *Domain-Specific Languages for Enterprise Systems*. Technical Report, Department of Computer Science, University of Copenhagen, 2011.
- [38] Patrick Bahr. *Infinitary Term Graph Rewriting*. Technical Report, University of Copenhagen, 2011.
- [39] Patrick Bahr. *Implementation of a Pragmatic Translation from Haskell into Isabelle/HOL*. Technical Report, NICTA, 2008.

### Theses

- [40] 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.
- [41] Patrick Bahr. *Infinitary Rewriting - Theory and Applications*. Master's Thesis, Vienna University of Technology, 2009.
- [42] Patrick Bahr. *An Executable Rewriting Logic Semantics for Concurrent Haskell*. Bachelor's Thesis, Dresden University of Technology, 2007.