

Fredrik Nordvall Forsberg

Computer and Information Sciences
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Curriculum vitae

Research interests

- Martin-Löf Type Theory
- Constructive mathematics
- Functional, Dependently Typed Programming
- Category theory
- Advanced inductive definitions
- Applications of Higher Inductive Types to Computer Science

Education

- 2009–2013 **PhD**, *Computer Science*, Swansea University.
Funded by EPSRC grant EP/G033374/1, *Theory and applications of induction-recursion*. PhD thesis *Inductive-inductive definitions* supervised by Dr. Anton Setzer.
- 2004–2009 **BSc & MSc**, *Mathematics*, Uppsala university.
Master thesis *Constructive aspects of models for non-standard analysis* supervised by Prof. Erik Palmgren.
- 2006–2007 **ERASMUS exchange year**, *Mathematics, computer science*, Ruprecht-Karls-Universität Heidelberg.

Work Experience

- Dec 2013– **Research Associate**, *Computer and Information Sciences*, University of Strathclyde.
Working on EPSRC grant EP/K023837/1, *Logical Relations for Program Verification*. Principal Investigator: Prof. Neil Ghani.
- 2013 **Postdoctoral Research Fellow**, *School of Computer Science*, University of Birmingham, June–December.
Working on EPSRC grant EP/K015214/1, *A Higher-Order Approach to Co-design*. Principal Investigator: Dr. Dan Ghica.
- 2012 **Short term research fellow**, *Mathematics department*, Ludwig-Maximilians-Universität München, 5 months July–November.
Funded by the Marie Curie Initial Training Network in Mathematical Logic — MALOA, PITN-GA-2009-238381. Visited Prof. Helmut Schwichtenberg.

Teaching experience

- 2016–2017 **University of Strathclyde**, *CS316 Functional Programming*.
Lecturer together with Dr. Robert Atkey, Dr. James Chapman and Dr. Conor McBride. Delivered lectures and tutorials, and designed and marked coursework.
- 2015–2016 **University of Strathclyde**, *CS106 Computer Systems and Organisation*.
Lecturer together with Dr. Conor McBride. Delivered lectures and tutorials, marked tests. Designed infrastructure for rapid feedback and marking, and designed and marked coursework.
7 nominations for Teaching Excellence Award.
- 2013 **University of Birmingham**, *Foundations of Computer Science*.
Teaching Assistant and Guest lecturer.
- 2010–2011 **Swansea University**, *Concurrency; Language and Computation*.
Teaching Assistant, Lab Demonstrator.
- 2007–2008 **Uppsala University**, *Linear Algebra; Calculus; Multivariable Calculus*.
Tutorial teacher.

2007 **Ruprecht-Karls-Universität Heidelberg**, *Algorithmen und Datenstrukturen*.
Tutorial teacher (“Übungsgruppenleiter”).

Funding obtained

Scottish Programming Languages Seminar, SICSA Research Theme Event Sponsorship £800, *co-applicant* together with Dr. James Chapman and Dr. Robert Atkey. Funding for a workshop with 61 participants, 9 November 2016.

Data-parallel programming with Higher Inductive Types, SICSA PECE bursary, £5,201, *PI*. Funding for a two-month visit to Dr. Dan Licata at Wesleyan University, USA to work on data-parallel programming using HITs, January–March 2017.

Agda Implementors’ Meeting XXIII, SICSA Research Theme Event Sponsorship £1,400, *co-applicant* together with Dr. James Chapman. Funding for a week-long meeting with 22 participants from across Europe, 20–26 April 2016.

Homotopy Type Theory: Programming and Verification EPSRC EP/M016951/1, £499,631, *co-writer* assisting Prof. Neil Ghani. 1 April 2015–31 March 2019.

Organisational duties

2016 **Agda Implementor’s Meeting XXIII**, 20–26 April, *co-organiser*.

2014– **MSP101 seminar**, *Strathclyde*, *organiser*.

2014– **ScotCats**, *Scottish Category Theory Seminar*, *co-organiser*.

2010–2013 **Proof, Complexity and Verification seminar**, *Swansea*, *co-organiser*.

2011–2012 **Categorical logic seminar**, *Swansea*, *organiser*.

2012–2013 **Realizability seminar**, *Swansea*, *organiser*.

Program Committee Membership

2017 **TYPES**, *Types for Proofs and Programs*.

2016 **CoALP-Ty**, *Workshop on Coalgebra, Horn Clause Logic Programming and Types*.

2016 **CMCS**, *Coalgebraic Methods in Computer Science*.

2015 **MFPS**, *Mathematical Foundations of Programming Semantics*.

Refereeing

Journals Logical Methods in Computer Science, Progress in Informatics, Computability, Journal of Logic and Computation, Journal of the ACM, Post-proceedings of the workshop on Coalgebra, Horn Clause Logic Programming and Types.

Conferences Logic In Computer Science (×3), Typed Lambda Calculus and Applications, Computability in Europe, Mathematically Structured Functional Programming (×2), Classical Logic and Computation, Mathematical Foundations of Programming Semantics (×2), Coalgebraic Methods in Computer Science, Mathematical Foundations of Computer Science, European Symposium on Programming, Interactive Theorem Proving, Types for Proofs and Programs.

Professional Activities and Visits

- Invited participant *Proof and Computation* Autumn school, Herrsching, Germany, September 2017.
- Reviewer for *Mathematical Reviews* since 2017.
- Visiting scholar at Wesleyan University, USA, 23 January–23 March 2017. Hosted by Dr. Daniel Licata.
- Invited participant *Proof and Computation* Autumn school, Fischbachau, Germany, October 2016.

- Visitor at University of Ljubljana, Slovenia, 16–20 May 2016. Hosted by Prof. Alex Simpson.
- Invited participant *Mathematics for Computation* workshop, Niederalteich, Germany, May 2016.
- European Association for Theoretical Computer Science ETAPS Best Theory Paper Award, April 2016.
- Invited speaker *Mathematically Structured Functional Programming* workshop, Eindhoven, the Netherlands, April 2016.
- Visitor at Carnegie-Mellon University, Pittsburgh, USA, 25 August–24 September 2014. Hosted by Prof. Steve Awodey.
- Visitor at University of Nottingham, UK, 16–20 June 2014. Hosted by Dr. Thorsten Altenkirch.
- Visitor at Stockholm University, Sweden, 9–13 June 2014. Hosted by Prof. Erik Palmgren.
- Invited attendee at Dagstuhl Seminar 11411 *Computing with Infinite Data: Topological and Logical Foundations*, October 2011.
- Visitor at University of Leicester, UK, 3–4 September 2011. Hosted by Prof. Alexander Kurz.

Invited presentations

- 2017/05/03 **Proofs, Constructions, and Computations Seminar**, University of Leeds, UK. *Variations on inductive-recursive definitions.*
- 2016/05/16 **Foundations Seminar**, University of Ljubljana, Slovenia. *Applications and theory of Higher inductive types.*
- 2016/05/03 **LFCS Seminar**, University of Edinburgh, UK. *Comprehensive parametric polymorphism.*
- 2016/04/08 **MSFP invited talk**, ETAPS 2016. *Higher inductive types in Homotopy Type Theory: applications and theory.*
- 2016/03/11 **Logic and Semantics Seminar**, University of Cambridge, UK. *Comprehensive parametric polymorphism.*
- 2015/04/29 **LFCS Seminar**, University of Edinburgh, UK. *Inductive-inductive definitions in Type Theory.*
- 2014/09/22 **POP Seminar**, Carnegie-Mellon University, Pittsburgh, US. *Towards a Presentation of General Higher Inductive Types.*
- 2014/06/11 **Stockholm Logic Seminar**, Stockholm University, Sweden. *Inductive-inductive definitions in Intuitionistic Type Theory.*
- 2012/11/27 **Oberseminar Theoretische Informatik**, LMU Munich, Germany. *Internalizing inductive-inductive definitions in Martin-Löf Type Theory.*
- 2012/07/11 **Oberseminar Mathematische Logik**, LMU Munich, Germany. *Inductive-inductive definitions in dependent type theory.*
- 2011/11/03 **CLOG seminar**, University of Leicester, UK. *Data types in dependent type theory.*
- 2011/10/28 **Theoretical computer science seminar**, University of Birmingham, UK. *Inductive-inductive definitions: axiomatisation and categorical semantics.*
- 2010/07/29 **Mathematically Structured Programming seminar**, University of Strathclyde, Glasgow, UK. *Inductive-inductive definitions as initial dialgebras.*
- 2010/11/12 **Functional Programming Lab seminar**, University of Nottingham, UK. *Interpreting inductive-inductive definitions as indexed inductive definitions.*

Languages

- Swedish **Native** ◦ English **Fluent** ◦ German **Good**

Computer skills

Languages Haskell, SML, Scheme, L^AT_EX, C, Java.
 Proof assistants Agda, Coq, Minlog.

Development Contributed to the development of Agda (anonymous pattern matching functions, warning system) and Minlog (program extraction to Haskell).

Publications

Note that in Computer Science, conference papers count equally with journal papers.

Journal papers

1. Neil Ghani, Fredrik Nordvall Forsberg and Federico Orsanigo. **A universal property for parametric polymorphism.** Accepted for publication in *Mathematical Structures in Computer Science*, 2017.
2. Neil Ghani, Lorenzo Malatesta and Fredrik Nordvall Forsberg. **Positive Inductive-Recursive Definitions.** in *Logical Methods in Computer Science*, 11(1:13), 2015.
3. Ulrich Berger, Andrew Lawrence, Fredrik Nordvall Forsberg and Monika Seisenberger. **Extracting verified decision procedures: DPLL and Resolution.** in *Logical Methods in Computer Science*, 11(1:6), 2015.

Conference papers

4. Neil Ghani, Conor McBride, Fredrik Nordvall Forsberg and Stephan Spahn. **Variations on inductive-recursive definitions.** Accepted for publication in *Mathematical Foundations of Computer Science*, 2017.
5. Neil Ghani, Fredrik Nordvall Forsberg and Alex Simpson. **Comprehensive parametric polymorphism: categorical models and type theory.** In *Foundations of Software Science and Computation Structures*, volume 9634 of *Lecture Notes in Computer Science*, pages 3–19, Springer, 2016. *ETAPS Best Theory Paper Award.*
6. Neil Ghani, Fredrik Nordvall Forsberg and Federico Orsanigo. **Proof relevant parametricity.** In *A List of Successes that can Change the World*, volume 9600 of *Lecture Notes in Computer Science*, pages 109–131, Springer, 2016.
7. Neil Ghani, Patricia Johann, Fredrik Nordvall Forsberg, Federico Orsanigo and Tim Revell. **Bifibrational functorial semantics of parametric polymorphism.** In *Mathematical Foundations of Programming Semantics XXXI*, volume 319 of *Electronic Notes in Theoretical Computer Science*, pages 165–181, Elsevier, 2015.
8. Robert Atkey, Neil Ghani, Fredrik Nordvall Forsberg, Tim Revell and Sam Staton. **Models for Polymorphism over Physical Dimensions.** In *Typed Lambda Calculi and Applications*, volume 38 of *Leibniz International Proceedings in Informatics*, pages 45–59, Schloss Dagstuhl–Leibniz-Zentrum für Informatik, 2015.
9. Neil Ghani, Fredrik Nordvall Forsberg and Federico Orsanigo. **Parametric polymorphism — universally.** In *Workshop on Logic, Language, Information and Computation*, volume 9160 of *Lecture Notes in Computer Science*, pages 81–92, Springer, 2015.
10. Neil Ghani, Lorenzo Malatesta and Fredrik Nordvall Forsberg. **Positive Inductive-Recursive Definitions.** Invited paper in *Conference on Algebra and Coalgebra in Computer Science*, volume 8089 of *Lecture Notes in Computer Science*, pages 19–33, Springer, 2013.
11. Neil Ghani, Lorenzo Malatesta, Fredrik Nordvall Forsberg and Anton Setzer. **Fibred Data Types.** In *Logic in Computer Science*, pages 243–252, IEEE Computer Society, 2013.
12. Kenji Miyamoto, Fredrik Nordvall Forsberg and Helmut Schwichtenberg. **Program Extraction from Nested Definitions.** In *Interactive Theorem Proving*, volume 7998 of *Lecture Notes in Computer Science*, pages 370–385, Springer, 2013.
13. Fredrik Nordvall Forsberg and Anton Setzer. **A finite axiomatisation of inductive-inductive definitions.** In *Logic, Construction, Computation*, volume 3 of *Ontos Mathematical Logic*, De Gruyter, 2012.

14. Thorsten Altenkirch, Peter Morris, Fredrik Nordvall Forsberg, and Anton Setzer. **A categorical semantics for inductive-inductive definitions**. In *Conference on Algebra and Coalgebra in Computer Science*, volume 6859 of *Lecture Notes in Computer Science*, pages 70–84, Springer, 2011.
15. Fredrik Nordvall Forsberg and Anton Setzer. **Inductive-inductive definitions**. In *Computer Science Logic*, volume 6247 of *Lecture Notes in Computer Science*, pages 454–468, Springer, 2010.

Theses

16. Fredrik Nordvall Forsberg. **Inductive-inductive definitions**. PhD thesis. Swansea University, 2014.
17. Fredrik Nordvall Forsberg. **Constructive aspects of models for non-standard analysis**. Master thesis. *U.U.D.M. Project report 2009:10*, Uppsala University, 2009.