

# Fredrik Nordvall Forsberg

Computer and Information Sciences  
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Curriculum vitae

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## Research interests

- Martin-Löf Type Theory
- Functional Programming
- Compositional Game Theory
- Category theory
- Advanced inductive definitions
- Applications of Higher Inductive Types to Computer Science

## Education

- 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. Viva date: 24 September 2013. Degree obtained 23 January 2014.
- 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.

## Employment

- 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. (Until 2017.)
- 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.

## Teaching experience

- 2017–2018 **Functional Programming**, *University of Strathclyde*.  
Lecturer together with Dr. Robert Atkey. Delivered lectures and tutorials, and designed and marked coursework.
- 2016–2017 **Functional Programming**, *University of Strathclyde*.  
Lecturer together with Dr. Robert Atkey, Dr. James Chapman and Dr. Conor McBride. Delivered lectures and tutorials, and designed and marked coursework.
- 2015–2016 **Computer Systems and Organisation**, *University of Strathclyde*.  
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.*

Teaching assistant

- 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

- 2018 **CAPNSS**, *Compositional Approaches in Physics, NLP, and the Social Sciences*.
- 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, Archive for Mathematical Logic.

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

## Professional Activities and Visits

- Editor TYPES 2017 post-proceedings, 2017.
- 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<sup>A</sup>T<sub>E</sub>X, 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, Clemens Kupke, Alasdair Lambert and Fredrik Nordvall Forsberg. **A Compositional Treatment of Iterated Open Games**. Accepted for publication in *Theoretical Computer Science*, 2018.
2. Neil Ghani, Fredrik Nordvall Forsberg and Federico Orsanigo. **Universal properties for universal types in bifibrational parametricity**. Accepted for publication in *Mathematical Structures in Computer Science*, 2017.
3. Neil Ghani, Lorenzo Malatesta and Fredrik Nordvall Forsberg. **Positive Inductive-Recursive Definitions**. in *Logical Methods in Computer Science*, 11(1:13), 2015.
4. 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

5. Thorsten Altenkirch, Paolo Capriotti, Gabe Dijkstra, Nicolai Kraus and Fredrik Nordvall Forsberg. **Quotient Inductive-Inductive Types**. In *Foundations of Software Science and Computation Structures*, 2018.
6. Neil Ghani, Conor McBride, Fredrik Nordvall Forsberg and Stephan Spahn. **Variations on inductive-recursive definitions**. In *Mathematical Foundations of Computer Science*, volume 83 of *Leibniz International Proceedings in Informatics*, pages 63:1–63:13, Schloss Dagstuhl–Leibniz-Zentrum für Informatik, 2017.
7. 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*.
8. 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.

9. 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.
  10. 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.
  11. 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.
  12. 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.
  13. 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.
  14. 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.
  15. 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.
  16. 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.
  17. 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**
18. Fredrik Nordvall Forsberg. **Inductive-inductive definitions**. PhD thesis. Swansea University, 2014.
  19. Fredrik Nordvall Forsberg. **Constructive aspects of models for non-standard analysis**. Master thesis. *U.U.D.M. Project report 2009:10*, Uppsala University, 2009.