Floris van Doorn

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Research Interests

My main research focuses are Homotopy Type Theory and interactive theorem proving. In homotopy type theory I've been mostly working on synthetic homotopy theory, finding reductions of higher inductive types, and formalization. I am the main contributor of the Lean-HoTT library.[1] I was the main contributor to the formalization of spectral sequences in synthetic homotopy theory.[2]

Publications

- "Homotopy Type Theory in Lean," with Jakob von Raumer and Ulrik Buchholtz. *8th International Conference on Interactive Theorem Proving* (ITP), 2017
- "Constructing the Propositional Truncation using Non-recursive HITs." *The 5th ACM SIGPLAN Conference on Certified Programs and Proofs* (CPP), 2016.
- "The Lean Theorem Prover (system description)," with Leonardo de Moura (first author), Soonho Kong, Jeremy Avigad and Jakob von Raumer. *The 25th jubilee edition of the International Conference on Automated Deduction* (CADE), 2015.
- "The Structural Theory of Pure Type Systems," with Cody Roux (first author). *LNCS Advanced Research in Computing and Software Science 2014.*
- "Explicit convertibility proofs in Pure Type Systems," with Herman Geuvers and Freek Wiedijk. *Proceedings of the Workshop on Logical Frameworks and Meta-languages: Theory and Practice (LFMTP), 25-36, 2013.*

Talks

- "Formalized Spectral Sequences in Homotopy Type Theory,", *Algebra, Combinatorics, and Geometry seminar*, University of Pittsburgh, 2017 (two talks)
- "Homotopy Type Theory in Lean," *Computer-aided mathematical proof*, Cambridge, 2017 (aimed towards the ITP community).
- "The Lean HoTT library," *Big Proof*, Cambridge, 2017 (aimed towards the HoTT community).

[1] https://github.com/leanprover/lean2/blob/master/hott/hott.md
[2] https://github.com/cmu-phil/Spectral

- "The Lean-HoTT library and the smash product," *MURI meeting*, CMU, 2017.
- "Eilenberg-MacLane spaces in Homotopy Type Theory," *ASL North American annual meeting*, Boise, 2017
- "Homotopy Type Theory in Lean," *Univalent Foundations and Proof Assistants, ICMS*, 2016.
- "Homotopy Type Theory in Lean," *Workshop on Homotopy Type Theory / Univalent Foundations*, colocated with FSCD, 2016.
- "Reducing higher inductive types to quotients," *Workshop on Homotopy Type Theory and Univalent Foundations of Mathematics*, Fields Insitute Toronto, 2016.
- "The Lean Theorem Prover and Homotopy Type Theory," talk together with Jeremy Avigad. *Workshop on Homotopy Type Theory and Univalent Foundations of Mathematics*, Fields Insitute Toronto, 2016.
- "The Lean-HoTT library and HITs in Lean," *MURI meeting*, CMU, 2016.

Other written work

- "Logic and Proof," Jeremy Avigad, Robert Y. Lewis, Floris van Doorn. Lecture notes for the course Logic and Mathematical Inquiry.
- "The Lean Theorem Prover," Floris van Doorn. Homotopy Type Theory blog, 2 December 2015. `http://homotopytypetheory.org/2015/12/02/the-proof-assistant-lean/`
- "Constructing the Propositional Truncation using Nonrecursive HITs," Floris van Doorn. Homotopy Type Theory blog, 28 July 2015. `http://homotopytypetheory.org/2015/07/28/constructing-the-propositional-truncation-using-nonrecursive-hits/`
- "Propositional Calculus in Coq," Floris van Doorn. arXiv:1503.08744, 9 May 2014.
- "Roosters Kleuren" (Dutch, "coloring grids"), Floris van Doorn. Vakidioot 11/12(5):20-21
- "Op weg naar IMO2011 - IMO2008 opgave 5" (Dutch, "Towards IMO2011 - IMO2008 problem 5"), Floris van Doorn. Euclides 86(4):142-143
- "Wiskunde in Vietnam" (Dutch, "Mathematics in Vietnam"), Floris van Doorn. Pythagoras 47(3):20 (jan. 2008).
- "De eerste ronde van de Nederlandse Wiskunde Olympiade 2006 – 2008. Een bundel met opgaven en uitgebreide uitwerkingen" (Dutch, "The first round of the Dutch Mathematical Olympiad 2006 – 2008. A booklet with problems and extensive solutions"), Floris van Doorn, Alexander van Hoorn, Maarten Roelofsma. Unpublished booklet.

Education

2013-present	**Ph.D. student in Pure and Applied Logic in the Philosophy department of Carnegie Mellon University**
2011-2013	**M.Sc. (cum laude), Mathematical Sciences, Utrecht University**; Average grade: 9.3 (out of 10). Total ECTS: 156 (120 needed). Thesis: 'Explicit convertibility proofs in Pure Type Systems' about a variant of PTSs where there are explicit proofs of beta conversion which are added to the term in the conversion rule. The complete proof was formalised in Coq.
2008-2011	B.Sc. (cum laude), Mathematics, Utrecht University; B.Sc. (cum laude), Physics and Astronomy, Utrecht University; Average grade: 9.1 (out of 10) ; total ECTS: 304.25 (180 needed). Thesis (with Jasper Mulder): 'Lattices and Topological Systems'
2002-2008	High school at Comenius College Hilversum

Languages: Dutch (mother tongue), English (fluent), German (basic), French (basic).
Programming: LaTeX (fluent), Lean (fluent), Mathematica (good), Coq (intermediate), C (basic), standard ML (basic).

Teaching

Fall 2016	TA for Differential and Integral Calculus with Russell C. Walker (CMU)
Fall 2015	TA for Logic and Mathematical Inquiry with Jeremy Avigad (CMU)
Spring 2015	TA for Game Theory with Adam Bjorndahl (CMU)
Fall 2014	TA for Formal Logic with Steve Awodey (CMU)
Spring 2012	TA for Discrete Mathematics with Han Hoogeveen (UU)
Fall 2011	TA for Foundations of Mathematics with Jaap van Oosten (UU)

Volunteering

2009-2013	**Trainer of the Dutch Mathematical Olympiad.** Every year the top 30 high school students are selected for this training which prepares them for international contests, most notably the International Mathematics Olympiad. As a trainer one has to create problem sets, give training sessions, give feedback on homework exercises, invigilate during exams and grade exam problems.
2009-2013	**Volunteer for 'Vierkant voor Wiskunde'** mathematics summer camps. This is a camp for children between 10 and 18. It entails preparing mathematical problem booklets, watching over the participants during the camp, and helping them with mathematical problems.
2012-2013	Organizing the Benelux Mathematical Olympiad (BxMO) 2013 as chairman.
2011-2012	Organizing the Dutch University Mathematical Olympiad (LIMO in Dutch) 2012 as treasurer. This is a teamed mathematics competition for university students in the Netherlands and Belgium.
2010-2011	Member of the IT committee for the IMO 2011.
2009-2010	Organizing the BxMO 2010 as head awards ceremony.
2008-2009	Organizing the BxMO 2009 as secretary.

Achievements

I have participated three times in the IMC (International Mathematics Competitions), and once in the IMO (International Mathematical Olympiad).

IMC 2012	first prize	(placed 7th out of 315 contestants)
IMC 2011	second prize	(placed 61st out of 305 contestants)
IMC 2010	second prize	(placed 121st out of 328 contestants)
IMO 2008	silver medal	(placed 127th out of 535 contestants)

I also participated in various national mathematics contests in the Benelux, including several editions of the LIMO (a teamed mathematics contest for university students in the Netherlands and Belgium), PUMA (an individual mathematics contest in Ghent, Belgium), MOAWOA (an individual mathematics contest held in Utrecht), reaching the top 5 in each contest.
I also received the KHMW "Jong Talent Aanmoedigingsprijs" (lit. "Young Talent Incentive Price") for mathematics in 2009, for having high grades after the first year of college. The KHMW is the "Royal Holland Society of Sciences and Humanities."