Robert Robere

IAS-DIMACS Postdoctoral Fellow
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Research Interests.

Computational complexity theory, circuit complexity, proof complexity, and interactions between them. Theory and practice of SAT algorithms.

Education.

- **Ph.D. in Computer Science** (2013 - 2018)
  University of Toronto, Toronto, Canada.
  Advisors: Toniann Pitassi and Stephen Cook
  Thesis Title: *Unified lower bounds for monotone computation.*
- **Master of Science in Computer Science** (2012-2013)
  University of Toronto, Toronto, Canada.
  Advisors: Toniann Pitassi and Stephen Cook
  Project Title: *Average case lower bounds for monotone switching networks.*
- **Bachelor of Science in Computer Science (Honours)** (2007-2012)
  Minor: Mathematics
  Memorial University of Newfoundland, St. John's, Canada.
  Graduated with First Class Distinction.
  Awarded Medal of Academic Achievement in Computer Science.

Professional Experience

- **IAS-DIMACS Postdoctoral Fellow** (January 2019 – August 2020)
  DIMACS, New Brunswick, New Jersey, U.S.A. (January 2019 – August 2019)
  Institute for Advanced Study, Princeton, New Jersey, U.S.A. (September 2019 – August 2020)
- **Research Fellow** (August 2018 – December 2018)
  Simons Institute, University of California, Berkeley, U.S.A.
  Researcher and participant in the program "Lower Bounds in Computational Complexity".
- **Sessional Course Instructor** (January 2014 – May 2014, January 2016 – May 2016)
  University of Toronto, Toronto, Canada.
  Curriculum design, giving lectures, organizing TAs, grading, etc.
- **Teaching Assistant** (January 2012 – June 2018)
  University of Toronto, Toronto, Canada.
  Assisted in the teaching of several courses. Duties include marking, giving tutorials, and assisting in curriculum design.
- **Research Assistant** (September 2009 – January 2012)
  Memorial University of Newfoundland, St. John's, Canada.
  Supervisors: Todd Wareham and Antonina Kolokolova
  Assisted on research in various projects related to computer science theory.

- **Assistant System Programmer** (May 2009 – August 2009)
  Memorial University of Newfoundland, St. John's, Canada.
  Duties included the creation of web applications and university-wide backup software.

Awards and Honours.

- NSERC Postdoctoral Fellowship (2018-2020)
- Walter C. Sumner Memorial Fellow (2017-2018)
- Invited journal article "*Exponential Lower Bounds for Monotone Span Programs*" at FOCS 2016. (Honour reserved for top 5-10 papers in conference.)
- University of Toronto CSSU Instructor Award (2014)
  Awarded for CSC373 – Algorithm Design and Analysis
- NSERC Alexander Graham Bell Canada Graduate Scholarship-Doctoral (2014-2017)
- Cognitive Science Society Prize for Best Student Paper (2013)
  Awarded for the paper "*When almost is not even close: remarks on the approximability of HDTP*". Received at the sixth conference of Artificial and General Intelligence, 2013.
- Medal of Academic Achievement in Computer Science (2012)
- Memorial University Faculty of Science Book Prize — Computer Science (2011)
- NSERC Undergraduate Student Research Assistantship (2011)
- Samuel, Millicent, and Thomas Grandy Scholarship (2011)
- Memorial University Dean's List (2008-2012)
- Memorial University Early Entrance Scholarship (2007)

Professional Service.

External Reviewer: STOC, CCC, ICALP, FSTTCS, Algorithmica, Information Processing Letters.

Teaching.

I have been a course instructor for the following courses at the University of Toronto:

- CSC363 — Computability and Complexity. One appointment.
- CSC373 — Algorithm Design and Analysis. One appointment.

I have been a teaching assistant for the following courses at the University of Toronto:

- CSC463 — Computational Complexity and Computability. One appointment.
- CSC438/2404 — Computability and Logic. Three appointments.
- CSC373 — Algorithm Design and Analysis. Four appointments.
- CSC2420 — Algorithm Design, Analysis, and Theory (Graduate course). One appointment.
- CSC265 — Data Structures and Analysis (Advanced). One appointment.
- CSC263 — Data Structures and Analysis. One appointment.
- CSC165 — Mathematical Expression and Reasoning in Computer Science. One appointment.

Invited Talks, Plenary Lectures, and Notable Workshops Attended

- Simons Institute Theory Seminar, Berkeley, U.S.A. (2018)
  Invited Speaker.
  Seminar Title: *Lifting with Simple Gadgets and Applications for Cutting Planes.*

- Boolean Devices Workshop, Simons Institute, Berkeley, U.S.A (2018)
  Participant/Speaker.
  Seminar Title: *Lifting Nullstellensatz Degree to Monotone Span Program Size.*

- Proof Complexity, Dagstuhl Seminar 18051, Germany (2018)
  Participant/Speaker.
  Seminar Title: *Lifting Nullstellensatz Degree to Monotone Span Program Size.*

- Hardness Escalation in Communication Complexity and Query Complexity (FOCS), Berkeley, U.S.A. (2017)
  Partipant/Speaker.
  Seminar Title: *Lifting Nullstellensatz Degree to Monotone Span Program Size.*

- Proof Complexity and Beyond, MFO Oberwolfach, Germany (2017)
  Participant/Speaker.
  Seminar Title: *Lower Bounds for Monotone Computation: Unified and Optimal.*

- KTH Royal Institute of Technology, Stockholm, Sweden (2017)
  Invited Speaker.
  Seminar Title: *Lower Bounds for Monotone Computation: Unified and Optimal.*

- Institute for Advanced Study, Princeton, U.S.A. (2017)
  Invited Speaker.
  Seminar Title: *Applications of Monotone Constraint Satisfaction.*

- IEEE Foundations of Computer Science (FOCS), New Brunswick, U.S.A. (2016)
  Plenary Speaker.
  Seminar Title: *Exponential Lower Bounds for Monotone Span Programs.*

- BIRS Computational Complexity Workshop 16w5044, Banff, Canada (2016)
  Participant/Speaker.
  Seminar Title: *Unified Lower Bounds for Monotone Computation.*

- St. Petersburg Low Depth Complexity Workshop, St. Petersburg, Russia (2016)
  Invited Speaker.
  Seminar Title: *Unified Lower Bounds for Monotone Computation.*

- Third Annual Heidelberg Laureate Forum, Heidelberg, Germany (2015)
  Participant

- China Theory Week, Shanghai Jiao Tong University, Shanghai, China (2015)
  Participant/Speaker.
  Seminar Title: *Path Graphs, Clique Trees, and Flowers.*

Publications.

Refereed Conference Papers.

1. Mika Göös, Pritish Kamath, Robert Robere, Dmitry Sokolov. Adventures in Monotone Complexity and TFNP. *To appear at ITCS 2019.*

2. Edward Zulkoski, Ruben Martins, Christoph Wintersteiger, Robert Robere, Jia Liang, Vijay Ganesh. Extending Learning Sensitive Backdoors with Restarts. *Proceedings of the 24th International Conference on Principles and Practice of Constraint Programming (CP 2018).*

3. Robert Robere, Antonina Kolokolova and Vijay Ganesh. The Proof Complexity of SMT Solvers. *Proceedings of the 30th annual International Conference on Computer Aided Verification (CAV 2018).*

4. Toniann Pitassi and Robert Robere. Lifting Nullstellensatz to Monotone Span Programs over any Field. *Proceedings of the 50th annual ACM Symposium on the Theory of Computing (STOC 2018). pp. 1207-1219.*

5. Paul Beame, Noah Fleming, Russell Impagliazzo, Antonina Kolokolova, Denis Pankratov, Toniann Pitassi and Robert Robere. Stabbing Planes. *Proceedings of the 9th Innovations in Theoretical Computer Science Conference (ITCS 2018).*

6. Noah Fleming, Denis Pankratov, Toniann Pitassi, Robert Robere. Random $\Theta(\log n)$-CNFs are hard for cutting planes. *Proceedings of the 58th annual IEEE Symposium on Foundations of Computer Science (FOCS 2017).*

7. Edward Zulkoski, Ruben Martins, Christoph Wintersteiger, Robert Robere, Jia Liang, Krzysztof Czarnecki, Vijay Ganesh. Relating complexity-theoretic paramateres with SAT solver performance. *Pragmatics of Constraint Reasoning Workshop (POCR 2017).*

8. Toniann Pitassi and Robert Robere. Strongly exponential lower bounds for monotone computation. *Proceedings of the 49th annual ACM Symposium on the Theory of Computing (STOC 2017). pp. 1246-1255.*

9. Robert Robere, Toniann Pitassi, Benjamin Rossman, and Stephen A. Cook. Exponential lower bounds for monotone span programs. *Proceedings of the 57th annual IEEE Symposium on Foundations of Computer Science (FOCS 2016).* (Among top 5-10 papers in conference invited to the special issue.)

10. Yuval Filmus, Toniann Pitassi, Robert Robere and Stephen A. Cook. Average case lower bounds for monotone switching networks. *Proceedings of the 54th annual IEEE Symposium on Foundations of Computer Science (FOCS 2013), pp. 598-607*

11. Tarek Richard Besold and Robert Robere. When almost is not even close enough: remarks on the approximability of HDTP. *Proceedings of the sixth annual conference on Artificial and General intelligence (AGI 2013), pp. 11-20.* (Best Student Paper Award.)

12. Tarek Richard Besold and Robert Robere. A note on tractability and artificial intelligence. *Proceedings of the sixth annual conference on Artificial and General intelligence (AGI 2013), pp. 170-173.*

13. Robert Robere and Tarek Richard Besold. Complex Analogies: Remarks on the Complexity of HDTP. *Proceedings of the 25th Australasian Joint Conference on Artificial Intelligence (AI 2012).*

14. Todd Wareham, Iris van Rooij and Robert Robere. A Change for the Better? Assessing the Computational Cost of Re-representation. *Proceedings of the 11th International Conference on Cognitive Modeling (2012).*

Book Chapters.

1. Tarek R. Besold and Robert Robere. When Thinking Never Comes To A Halt: Using Formal Methods in Making Sure Your AI Gets the Job Done Good Enough. *Fundamental Issues of Artificial Intelligence (2016). Volume 376:43-62*.

In Preparation.

1. Robert Robere. Stronger limitations on classical lower bound techniques. *In Preparation* (2018).

2. Susanna de Rezende, Or Meir, Jakob Nordström, Toniann Pitassi, Robert Robere, Marc Vinyals. Lifting with Simple Gadgets and Applications for Cutting Planes. *In Submission* (2018).

3. Lalla Mouatadid and Robert Robere. Path graphs, clique trees, and flowers. *In Submission* (2015).