

Edward A. Hirsch

edward.a.hirsch@gmail.com

+972-58-514-4215

Technion, Israel

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I have recently resigned from **Steklov Institute of Mathematics at St.Petersburg** (where I had a permanent position of Research Lead; I was heading the Laboratory of Mathematical Logic) and **St.Petersburg State University** (where I was a Full Professor) and joined **Technion** for a temporary research position.

Research interests

Proof complexity, Boolean satisfiability (SAT), Computational complexity.

Titles

- Professor of the Russian Academy of Sciences (elected 2015).
- Member of Academia Europaea (elected 2014).

Degrees

Habilitation (DSc in Mathematics), St.Petersburg State University, 2011.

Thesis: “The Complexity of Propositional Logic”.

PhD in Theoretical Computer Science, St.Petersburg State University, 1998.

Thesis: “Worst-case Upper Bounds for the Satisfiability Problem”.

Previous positions

1998—2022, Steklov Institute of Mathematics at St.Petersburg, Russian Academy of Sciences (last position: Research Lead (*permanent*) and Acting Head of the Laboratory of Mathematical Logic).

2000—2010 and 2015—2022, St.Petersburg University (last position: Full Professor (part-time)).

2008—2018, St.Petersburg Academic (now Alferov) University, Russian Academy of Science (last position: Full Professor (part-time)).

PhD Students

- Nikita Gaevoy (2021–... , current).
- Dmitry Itsykson (PhD 2009) — now at the Ben-Gurion University of the Negev, Israel,
- Alexander Knop (PhD 2017) — now at Google after three years at UCSD, USA,
- Arist Kojevnikov (PhD 2007) — went to the industry (OneSpin Solutions, Intel Mobile Communications, etc),
- Alexander S. Kulikov (PhD 2009) — now at Steklov Institute at St.Petersburg, Russia,
- Sergey I. Nikolenko (PhD 2009) — now at Steklov Institute at St.Petersburg, Russia,
- Konstantin Pervyshev (PhD 2009) — went to the industry (Yandex, Facebook, etc),
- Alexander Smal (PhD 2022) — now a postdoc in Technion, Israel,
- Dmitry Sokolov (joint with Dmitry Itsykson, PhD 2015) — now at EPFL, Switzerland (after KTH, Sweden and Steklov/SPbSU positions).

Master students:

Total of 13 supervised MSc theses including

- Yaroslav Alekseev (joining PhD studies now).

Lecture courses

I was teaching the following courses during my career:

- Algorithms–1, –2, –3.
- Algorithms and Programming.
- Advanced Algorithms.
- Computational Complexity–1, –2.
- Complexity Foundations of Cryptography.
- Proof Complexity.

Service to the community

I was involved in:

- Organizing The Complexity Semester in St.Petersburg (2016, together with Sam Buss).
- Starting a new conference series (CSR): <https://logic.pdmi.ras.ru/~csr/>
- Co-organizing the first SAT Competition of the new series (at SAT-2002): <http://www.satcompetition.org/2002/>
- Creating a new Math&CS Department at St.Petersburg State University that attracted a huge amount of exceptionally talented students: <https://math-cs.spbu.ru/en/news/news-new-department/>
- Creating a TCS group in St.Petersburg.
- Serving on multiple Councils including St.Petersburg Mathematical Society (2012–2022) and the Executive Board of Leonhard Euler International Mathematical Institute in St.Petersburg (<http://eimi.ru>).
- Program Committees of ESA-2007, CSR-2007/8/12/14/15, WoLLIC-2006, IWPEC-2006/9, SAT-2002/3/4/5/7/9, MFCS-2010, STACS-2013/19.

Research visits (one month or more)

- Technion (Israel) visiting Ofer Strichman and Yuval Filmus, April–July 2022.
- University of Rennes (France) visiting Dima Grigoriev, March 2005.
- Stanford University (USA) visiting Grigori Mints, January 2003.
- Technical University of Munich (Germany) visiting Ernst W. Mayr, January 2002.
- Delft University of Technology (The Netherlands) visiting Hans van Maaren, June 2001.
- The University of Manchester (UK) visiting Evgeny Dantsin and Andrei Voronkov, June 2000.
- Uppsala University (Sweden) visiting Andrei Voronkov, May 1997.

Research Grants and Projects (as Principal Investigator)

- Intel project “Decision Procedures for First Order Logic Arithmetic”, “Verifying Algebraic Circuits using Semi-Algebraic Approach” (7 participants), 2003–2005.
- INTAS 04-77-7173 (European Commission, The 5th Framework Programme) “Data Flow Systems: Algorithms and Complexity” (PI of St.Petersburg team, 6 participants), 2005–2007.
- Russian Science Support Foundation (individual), 2004-2005.
- Russian Foundation for Basic Research 06-01-00502 “Algorithms for automated design and analysis of algorithms for SAT” (8 participants).
- Russian Science Foundation 16-11-10123 “New methods for proving complexity bounds” (10 participants), 2016–2020.
- BASIS (Theoretical Physics and Mathematics Advancement Foundation) 21-7-1-20-1 “The complexity of propositional and algebraic proofs” (4 participants), 2021-2024 (terminated prematurely in August 2022, because most participants left Russia).

Awards, Fellowships

- Best EATCS Paper Award from European Association for Theoretical Computer Science, 2000, for the paper E.Dantsin, A.Goerd, E.A.Hirsch, U.Schöning, “Deterministic algorithms for k -SAT based on covering codes and local search.” Proceedings of ICALP’00, LNCS 1853, 236–243, Springer, 2000.
- Solver UnitWalk by Arist Kojevnikov and myself won SAT Competition 2003 category “all solvers on randomly generated satisfiable benchmarks”.
- Young Mathematician Fellowship from Dynasty Foundation <https://www.mccme.ru/dfc/2006/winners.html>, 2007–2009.
- Special Fellowship for Russian Researchers from Israel Academy of Science and Humanities, 2022.

Selected publications

- Y. Alekseev, D. Grigoriev, E. A. Hirsch, I. Tzameret. *Semi-Algebraic Proofs, IPS Lower Bounds and the τ -Conjecture: Can a Natural Number be Negative?* Proceedings of STOC-2020, pp.54–67.
- M. G. Find, A. Golovnev, E. A. Hirsch, A. Kulikov. *A better-than- $3n$ lower bound for the circuit complexity of an explicit function.* Proceedings of FOCS-2016, pp.89–98.
- E. A. Hirsch, D. Itsykson, I. Monakhov, A. Smal. *On optimal heuristic randomized semidecision procedures, with applications to proof complexity and cryptography.* THEORY OF COMPUTING SYSTEMS 51(2):179–195, 2012.
- E. A. Hirsch, E. Dantsin. *Worst-Case Upper Bounds.* In HANDBOOK OF SATISFIABILITY. IOS Press, 2009: 403–424.
- M. Alekhovich, E. A. Hirsch, D. Itsykson. *Exponential lower bounds for the running time of DPLL algorithms on satisfiable formulas.* JOURNAL OF AUTOMATED REASONING 35(1–3):51–72, 2005.
- D. Grigoriev, E. A. Hirsch, D. V. Pasechnik. *Complexity of Semi-Algebraic Proofs.* MOSCOW MATHEMATICAL JOURNAL 2(4): 647–679, 2002.
- E. Dantsin, A. Goerd, E. A. Hirsch, R. Kannan, J. Kleinberg, C. Papadimitriou, P. Raghavan, U. Schöning. *A Deterministic $(2 - 2/(k + 1))^n$ Algorithm for k -SAT Based on Local Search.* THEORETICAL COMPUTER SCIENCE 289/1: 69–83, 2002.
- E. A. Hirsch. *New Worst-Case Upper Bounds for SAT.* JOURNAL OF AUTOMATED REASONING 24(4): 397–420, Kluwer Academic Publishers, 2000.

Further links

- Math Genealogy: <https://www.genealogy.math.ndsu.nodak.edu/id.php?id=46485>
- Google Scholar profile: https://scholar.google.com/citations?user=p_CnQmOAAAAJ
- Personal web page: <https://edwardahirsch.github.io/edwardahirsch/>
- MathSciNet profile: <https://www.ams.org/mathscinet/search/author.html?mrauthid=629514>