Curriculum Vitae

Name: Pavel Hrubeš
Date of birth: 05/05/1980
Email: hrubes@math.cas.cz
Web: https://users.math.cas.cz/~hrubes

Current position

2014 – Researcher, Institute of Mathematics, Czech Academy of Sciences.
Žitná 25, 115 67, Prague, Czechia.

Education

2004–2007 Ph.D. degree in mathematics.
Faculty of Mathematics and Physics, Charles University, Czechia.

1998–2004 Master's degree in mathematics and philosophy.
Faculty of Mathematics and Physics, Faculty of Arts, Charles University, Czechia.

Long term research visits

2024 University of Copenhagen, Denmark. 1 month.
2022 University of Tel Aviv, Israel. 3 weeks.
2018 Simons Institute, Berkeley, USA. 1 semester.
2016 University of Washington, USA. 1 month.
2015 Institute for Advanced Study, USA. 1 month.

Postdoctoral positions

2013–2014 University of Washington, USA. A postdoc with A. Rao.
2010–2012 University of Calgary, Canada. A postdoc with R. Cockett.
2008–2010 Princeton, USA. A postdoc at the Institute for Advanced Study, with A. Wigderson, and Center for Computational Intractability, with S. Arora.
2008 University of Toronto, Canada. A postdoc with S. Cook.

Awards and selected invited lectures

2018 *Lower bound techniques in proof complexity*, Lower Bounds in Computational Complexity Workshop, Berkeley, USA.
2016 *Arithmetic circuits and proof complexity*, WACT, Tel Aviv, Israel.
2013 *The interpolation technique in proof complexity*, 25th International Conference on Computer Aided Verification, Saint Petersburg, Russia.
2008 *Proof complexity after* $NP \neq coNP$, Winter meeting of Association for Symbolic Logic, San Diego, USA.
2006 Kurt Gödel Centenary Research Prize Fellowship.

Supervision of younger researchers

Postdocs P. Chatterjee (2023) and N. Talebanfard (2019–2022).
Bachelor thesis supervisor of V. Fojtík (2018).

Teaching

2024 *Non-uniform computational models*, Charles University, Czechia.
2021 *Selected topics in computational complexity: mathematical tools*. Taught with N. Talebanfard and P. Pudlák, Charles University, Czechia.
2014 *Complexity of arithmetic computations*, University of Washington, USA.
2013 *Introduction to computational complexity*, University of Calgary, Canada.

Service for the mathematical community

– An organizer of *EPAC Workshop: Algorithms and Complexity*, 2023.
– An organizer of *Complexity Theory with a Human Face* workshop, 2020–2022.
– A program committee member of *34th Computational Complexity Conference*, 2019.
– A program committee member of *Prague Gathering of Logicians*, 2016.

Grants

2019–2023 Co-investigator of EXPRO grant 19-27871X of the Grant Agency of the Czech Republic (GAČR).

Bibliometric data

395 citations (SCOPUS), 224 citations (WOS), h-index: 10 (WOS).

Scientific achievements of a personal value

In proof complexity, obtained the first exponential lower bound on Frege style axiomatization of intuitionistic and modal logic [12], and on random formulas in Cutting Planes ([7], with P. Pudlák).

Related a classical problem of Hurwitz on sum of squares to arithmetic circuit complexity ([11], with A. Yehudayoff and A. Wigderson). Since then, made several contributions to Hurwitz's problem (most recently [1]). Initiated the study of the free skew field of non-commutative rational functions from complexity perspective [9] which turned out to have surprising algorithmic applications.

In [6], related the distribution of complex roots of a polynomial with the number of vertices of Newton polytope. This is a result in pure mathematics with applications to Tau conjectures and circuit complexity.

Selected publications

[1] P. Hrubeš. A subquadratic upper bound on sum-of-squares composition formulas. *ECCC*, 2024.
[2] S. Ben-David, P. Hrubeš, S. Moran, A. Shpilka, and A. Yehudayoff. Learnability can be independent of set theory (invited paper). In *STOC*, page 11, 2021.
[3] P. Hrubeš and A. Yehudayoff. Shadows of Newton polytopes. In *CCC*, 2021.
[4] P. Hrubeš. On ϵ-sensitive monotone computations. *Computational Complexity*, 29(2), 2020.
[5] P. Hrubeš. On the complexity of computing a random Boolean function over the reals. *Theory of Computing*, 16(9):1–12, 2020.
[6] P. Hrubeš. On the distribution of runners on a circle. *Eur. J. of Comb.*, 89, 2020.
[7] P. Hrubeš and P. Pudlák. Random formulas, monotone circuits, and interpolation. In *FOCS*, pages 121–131, 2017.
[8] P. Hrubeš and I. Tzameret. Short proofs for the determinant identities. *SIAM J. Comput.*, 44(2):193–2012, 2015.
[9] P. Hrubeš and A. Wigderson. Non-commutative circuits with division. *ITCS*, 2014.
[10] P. Hrubeš. On the real τ-conjecture and the distribution of complex roots. *Theory of Computing*, 9(10):403–411, 2013.
[11] P. Hrubeš, A. Wigderson, and A. Yehudayoff. Non-commutative circuits and the sum of squares problem. *J. Amer. Math. Soc.*, 24:871–898, 2011.
[12] P. Hrubeš. On lengths of proofs in non-classical logics. *Ann. Pure Appl. Logic*, 157(194-205), 2009.