

George Kenison

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Research Experience

Research Interests: Theory of Computation, Computational Complexity, Algebraic Dynamical Systems, Program Analysis, Automated Verification.

Research Fellow in Computer Science and Informatics., September 2023–
School of Computer Science and Mathematics, Liverpool John Moores University.

Postdoctoral Researcher in Automated Reasoning and Program Analysis., April 2021–August 2023
Institute of Logic and Computation, Technische Universität Wien.

Postdoctoral Researcher in Infinite-State Systems and Dynamical Systems., June 2018–March 2021
Department of Computer Science, University of Oxford.

Education

PhD in Mathematics, *University of Warwick.* 2017

Thesis: Asymptotics in conjugacy classes for free groups. EPSRC doctoral award funding.

MMath (Masters of Mathematics), *University of Warwick, First Class Hons.* 2013

Dissertation: Periodic orbits of hyperbolic and quasi-hyperbolic toral automorphisms

Publications

- 2024 (with S. Hitarth, L. Kovács, and A. Varonka). **Linear Loop Synthesis for Quadratic Invariants.** In: *41st International Symposium on Theoretical Aspects of Computer Science, STACS 2024*. Vol. 289, 41:1–41:18.
- 2024. **The Threshold Problem for Hypergeometric Sequences with Quadratic Parameters.** In: *51st International Colloquium on Automata, Languages, and Programming, ICALP 2024*. (To Appear), 124:1–124:20. arXiv: [2211.02447](https://arxiv.org/abs/2211.02447).
- 2023 (with L. Kovács and A. Varonka). **From Polynomial Invariants to Linear Loops.** In: *Proceedings of the 2023 International Symposium on Symbolic and Algebraic Computation, ISSAC 2023*, pp. 398–406.
- 2023 (with J. Nieuwveld, J. Ouaknine, and J. Worrell). **Positivity Problems for Reversible Linear Recurrence Sequences.** In: *50th International Colloquium on Automata, Languages, and Programming, ICALP 2023*, 130:1–130:17.
- 2023 (with K. Nosan, M. Shirmohammadi, and J. Worrell). **The Membership Problem for Hypergeometric Sequences with Quadratic Parameters.** In: *Proceedings of the 2023 International Symposium on Symbolic and Algebraic Computation, ISSAC 2023*, pp. 407–416.
- 2022. **On the Skolem Problem for Reversible Sequences.** In: *International Symposium on Mathematical Foundations of Computer Science, MFCS 2022*, 61:1–61:15.
- 2022 (with D. Amrollahi, E. Bartocci, L. Kovács, M. Moosbrugger, and M. Stankovič). **Solving Invariant Generation for Unsolvable Loops.** In: *Static Analysis: 29th International Symposium, SAS 2022*. **Radhia Cousot Award winning paper**, pp. 19–43.
- 2021 (with O. Klurman, E. Lefauchaux, F. Luca, P. Moree, J. Ouaknine, M. A. Whiteland, and J. Worrell). **On Positivity and Minimality for Second-Order Holonomic Sequences.** In: *International Symposium on Mathematical Foundations of Computer Science, MFCS 2021*, 67:1–67:15.
- 2020 (with R. Lipton, J. Ouaknine, and J. Worrell). **On the Skolem Problem and Prime Powers.** In: *International Symposium on Symbolic and Algebraic Computation, ISSAC 2021*.
- 2019 (with R. Sharp). **Statistics in conjugacy classes in free groups.** In: *Geom. Dedicata* 198.1, pp. 57–70.
- 2017 (with R. Sharp). **Orbit counting in conjugacy classes for free groups acting on trees.** In: *J. Topol. Anal.* 9.4, pp. 631–647.

Preprints

- (with D. Amrollahi, E. Bartocci, L. Kovács, M. Moosbrugger, and M. Stankovič). **(Un)Solvable Loop Analysis.** arXiv: [2306.01597](https://arxiv.org/abs/2306.01597).
- (with R. Ait El Manssour, M. Shirmohammadi, and J. Worrell). **Determination Problems for Orbit-Closures and Matrix Groups.**
- (with O. Klurman, E. Lefauchaux, F. Luca, P. Moree, J. Ouaknine, M. A. Whiteland, and J. Worrell). **On Inequality Decision Problems for Low-Order Holonomic Sequences.**
- (with R. Ait El Manssour, M. Shirmohammadi, and A. Varonka). **On the Complexity of Synthesising Simple Loop Programs.**

Technical Skills

Languages: Python, PARI/GP.

Tools: Matlab, Mathematica

Other: L^AT_EX, Git, SVN.

Teaching Experience

Co-lecturer for MSc course on *Formal Methods*, Summer 2022, Summer 2023
Institute of Logic and Computation, Technische Universität Wien.

Co-lecturer for MSc course *Probabilistic Model Checking*, Winter 2019/20
Department of Computer Science, University of Oxford.

Stipendiary Lecturer in Pure Mathematics, St Peter's College, Oxford. October 2018–September 2020

- **Academic tutor** for second year undergraduates. Tutorials in *Linear Algebra*, *Integration*, *Group Theory*, and *Graph Theory*. Duties included feedback, assessment, and writing progression reports.
- **Admissions interviewer** for mathematics and joint schools.

Teaching Associate, School of Mathematics, University of Bristol. August 2017–May 2018

- **Academic tutor** for *Linear Algebra*, *Calculus*, *Metric Spaces*, and *Geometry*.

Teaching Assistant, Mathematics Institute, University of Warwick. October 2013–June 2017

- **Undergraduate supervisor.** Small group teaching across the first year mathematics curriculum.
- **Support classes** in *Analysis*, *Metric Spaces*, *Experimental Maths*, *Mathematical Computing*, and *Dynamical Systems*.

Departmental Award for Outstanding Teaching, Mathematics Institute, University of Warwick.

Student Feedback.

- "Always prepared, always cheerful and always willing to go that extra mile in helping students to understand—a true inspiration!"
- "He was engaging, whilst provoking the students to find their own way to the answers."
- "I was involved in an incident in term one and if it wasn't for his support, both [academic and pastoral], I wouldn't have made it through the term and hence the year."
- "George made me feel comfortable asking questions and. . . his analysis classes were a highlight of my week."

Selected Seminar Talks

From Polynomial Invariants to Linear Loops, IRIF, Paris. Dec 2023

(Un)Solvable Loop Analysis, Liverpool. Oct 2023

Decision Problems for Hypergeometric Sequences, TU Wien and ISTA. Feb 2023

On the Skolem Problem and Reversible Sequences, Chalmers and Gothenburg. July 2022

On the Skolem Problem and Reversible Sequences, TU Wien and ISTA. May 2022

On Positivity and Minimality for Second-Order Holonomic Sequences, Open University. Sept 2021

On Positivity and Minimality for Second-Order Holonomic Sequences, TU Wien and ISTA. Sept 2021

Skolem's Problem and prime powers, Oxford. Feb 2019

Skolem's Problem and prime powers, Bristol. Dec 2018

Statistics in conjugacy classes in free groups, Warwick. Jan 2018

Asymptotics in conjugacy classes for free groups, Manchester. Nov 2017

Selected Conference and Workshop Talks

The Membership Problem for Hypergeometric Sequences with Quadratic Parameters, Tromsø, July 2023
International Symposium on Symbolic and Algebraic Computation.

On the Skolem Problem for Reversible Sequences, Kaiserslautern, Oct 2022
International Conference on Reachability Problems.

On the Skolem Problem for Reversible Sequences, Vienna, Aug 2022
International Symposium on the Mathematical Foundations of Computer Science.

On the Skolem Problem for Reversible Sequences, Paris, June 2022
Highlights of Logic, Games, and Automata.

On Positivity and Minimality for Second-Order Holonomic Sequences, Tallinn, Aug 2021
International Symposium on the Mathematical Foundations of Computer Science.

On the Skolem Problem and Prime Powers, Kalamata, July 2020
International Symposium on Symbolic and Algebraic Computation.

Skolem meets Euclid, Moorea, June 2019
Workshop on Dynamical Systems and Computation.

Asymptotics for free group actions, *Manchester*,
Workshop on Dynamical Systems, Ergodic Theory and Applications.

June 2016

Orbit counting in conjugacy classes for free groups acting on trees, *Goettingen*,
Summer School on Dynamical Approaches in Spectral Geometry.

Sept 2015

Widening Participation and Outreach

Mathematics in Education and Industry, *Problem Solving Matters: tutor and mentor*.

Summer 2017

Further Maths Support Programme, *STEP/AEA workshops, enrichment days, Royal Institution master-classes, and problem solving classes*.

2012–2019

Academic Service

Program Committee Member.

- RP. *International Conference on Reachability Problems* 2024

External Reviewer/Sub-Reviewer (Conferences).

- CASC. *Computer Algebra in Scientific Computing* 2022
- CONCUR. *International Conference on Concurrency Theory* 2023
- ICALP. *International Colloquium on Automata, Languages, and Programming* 2023, 2020
- ISSAC. *International Symposium on Symbolic and Algebraic Computation* 2024
- MFCS. *International Symposium on Mathematical Foundations of Computer Science* 2023, 2021
- POPL. *Principles of Programming Languages* 2023
- SODA. *Symposium on Discrete Algorithms* 2024
- STACS. *Symposium on Theoretical Aspects of Computer Science* 2023
- STOC. *Symposium on Theory of Computing* 2024
- TACAS. *Conference on Tools and Algorithms for the Construction and Analysis of Systems* 2023

External Reviewer/Sub-Reviewer (Journals).

- JMCS. *Journal of Mathematics and Computer Science*
- TOPLAS. *ACM Transactions on Programming Languages and Systems*
- FI. *Fundamenta Informaticae*

Organiser, *Workshop on Reachability, Recurrences, and Loops*, ICALP 2023 Satellite Workshop.

10 July 2023

Autobóz, *Annual Research Workshop on Automata, Logic, and Games*.

- **Steering Committee**, 2023–
- **Organiser**, Autobóz 2023 (16–22 July) in partnership with the *Highlights Collaborative Research Week*.
- **Speaker** Autobóz 2023: Tutorials on Decision Problems for Linear Recurrence Sequences.

Departmental & University Service

Pay and remuneration committee for sessional teachers, *Warwick*.

2015–2017

Staff & Graduate Student Liaison Committee (Mathematics), *Warwick*.

2014–2017

Professional Affiliation

Fellow of the Higher Education Academy.

Member of the Association of Computing Machinery.