George Kenison

School of Computer Science and Mathematics – Liverpool John Moores University
0000-0002-7661-7061 • georgekenison.github.io

Research Experience

Research Interests: Decision Problems, Program Analysis, Automated Verification, Dynamical Systems.

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. DOI: 10.4230/LIPIcs.STACS.2024.41.

• **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. DOI: 10.1145/3597066.3597109.

• **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*. Vol. 261, 130:1–130:17. DOI: 10.4230/LIPIcs.ICALP.2023.130.

• **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. DOI: 10.1145/3597066.3597121.

• **2022**. "On the Skolem Problem for Reversible Sequences". In: *International Symposium on Mathematical Foundations of Computer Science, MFCS 2022*, 61:1–61:15. DOI: 10.4230/LIPIcs.MFCS.2022.61.

• **2022** (with D. Amrollahi, E. Bartocci, L. Kovács, M. Moosbrugger, and M. Stankovič). "Solving Invariant Generation for Unsolvable Loops". In: *Static Analysis Symposium 2022*. Radhia Cousot Award winning paper, pp. 19–43. DOI: 10.1007/978-3-031-22308-2_3.

• **2021** (with O. Klurman, E. Lefaucheux, 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. DOI: 10.4230/LIPIcs.MFCS.2021.67.

• **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*. DOI: 10.1145/3373207.3404036.

• **2019** (with R. Sharp). "Statistics in conjugacy classes in free groups". In: *Geom. Dedicata* 198.1, pp. 57–70. DOI: 10.1007/s10711-018-0329-2.

• **2017** (with R. Sharp). "Orbit counting in conjugacy classes for free groups acting on trees". In: *J. Topol. Anal.* 9.4, pp. 631–647. DOI: 10.1142/S1793525317500261.

Preprints

• (with D. Amrollahi, E. Bartocci, L. Kovács, M. Moosbrugger, and M. Stankovič). *(Un)Solvable Loop Analysis*. arXiv: 2306.01597.

• (with R. Ait El Manssour, M. Shirmohammadi, and A. Varonka). *On the Complexity of Synthesising Simple Loop Programs*. Submitted.

• *The Membership and Threshold Problems for Hypergeometric Sequences with Quadratic Parameters*. arXiv: 2211.02447.

Technical Skills

Languages: Python, PARI/GP.

Tools: Matlab, Mathematica

Other: LaTeX, Git, SVN.

Teaching Experience

Co-lecturer for MSc seminar 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*, **June 2016**
Workshop on Dynamical Systems, Ergodic Theory and Applications.

Orbit counting in conjugacy classes for free groups acting on trees, *Goettingen*, **Sept 2015**
Summer School on Dynamical Approaches in Spectral Geometry.

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 masterclasses, 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.