# Toghrul Karimov

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## Academic employment

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| **04/2025 - present** | Postdoctoral researcher under the supervision of Valérie Berthé and Joël Ouaknine<br>Institut de Recherche en Informatique Fondamental (IRIF), Paris and Max Planck Institute for Software Systems (MPI-SWS), Saarbrücken, Germany<br>Funded by the ERC Synergy Grant "DnyAMiCs" |
| **03/2024 - 03/2025** | Postdoctoral researcher working with Joël Ouaknine<br>MPI-SWS, Saarbrücken, Germany |

## Education

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| **2019-2024** | PhD student at Saarland University and the MPI-SWS, Germany<br>Supervisor: Joël Ouaknine<br>Thesis: Algorithmic verification of linear dynamical systems<br>Received the grade *summa cum laude* |
| **2015-2019** | MCompSci Computer Science, University of Oxford, UK<br>First Class Honours |

## Scholarships and awards

1. Fellowship of the Hausdorff Research Institute for Mathematics (HIM) in Bonn to attend the Trimester Program "Definability, decidability, and computability", October 2025
2. ACM-SIGBED Best Paper Award at the conference Hybrid Systems: Computation and Control (HSCC) 2024 for the paper "Linear dynamical systems with continuous weight functions" together with R. Aghamov, C. Baier, J. Ouaknine, and J. Piribauer.
3. Distinguished Paper Award at the conference ACM/IEEE Symposium on Logic in Computer Science (LICS) 2024 for the paper "On the decidability of monadic second-order logic with arithmetic predicates" together with V. Berthé, J. Nieuvweld, J. Ouaknine, M. Vahanwala, and J. Worrell.
4. CPEC (see `www.perspicuous-computing.science`, Deutsche Forschungsgemeinschaft grant 389792660) mini-project award for a two-week research visit to Oxford University, June 2022.

5. Keble College Scholarship, 2016-2019. Awarded for excellent academic performance at the end of each year.

6. The Scholarship of the Ministry of Education of Azerbaijan covering the full costs of my study at the University of Oxford, 2015-2019.

## Teaching

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| **August 2025** | Gave a two-week intensive seminar on machine learning to university students in Baku, Azerbaijan; Some lecture notes can be found here |
| **Winter 2022** | "Topics in algorithmic dynamical systems theory", teaching assistant University of Saarland |
| **Summer 2020** | "Automata and sequences", teaching assistant University of Saarland |

## Invited talks and presentations

1. Some applications of o-minimality to computational problems in dynamical systems theory. *Topic seminar at the Hausdorff Research Institute for Mathematics*, Bonn, Germany, 2025.

2. Extensions of linear programming with squares and powers of integers. *Invited talk at Kyoto University*, Japan, 2025.

3. Arithmetic predicates and decidability of logical theories. *Invited talk at the Hausdorff Research Institute for Mathematics*, Bonn, Germany, 2025.

4. Extensions of linear programming with squares and powers of integers. *Invited talk at Kyoto University*, Japan, 2025.

5. Rich sequences and decidability of logical theories. *Numeration and Substitution*, Tsukuba, Japan, 2025.

6. Ergodicity for linear dynamical systems via o-minimality. *Highlights of Logic, Games, and Automata*, Saarbrücken, Germany, 2025.

7. From word combinatorics to automatic structures. Invited talk, *Workshop on Recent Developments in Arithmetic Theories and Applications*, Kolkata, India, 2025.

8. On the decidability of Presburger arithmetic expanded with powers. *SODA 2025*, New Orleans, United States.

9. Ode to o-minimality. *Symbolic Dynamics and Arithmetic Expansions* workshop in Roscoff, France, and *Stellenbosch University logic seminar*, South Africa, 2024.

10. The power of Positivity. *LICS 2023*, Boston, United States.

11. The model-checking problem for linear dynamical systems. *Workshop on Algorithmic Aspects of Dynamical Systems*, Barbados, 2023.

12. The pseudo-reachability problem for diagonalisable affine dynamical systems. *MFCS 2022*, Vienna, Austria, and *RP 2022*, Saarbrücken, Germany.

13. The pseudo-Skolem problem is decidable. *MFCS 2021*, Tallinn, Estonia.
14. Invariants and impossibility: from geometric constructions to solving polynomial equations. *Monsoon Math 2021*, an online camp for Indian students.
15. Deciding $\omega$-regular properties on linear recurrence sequences. *POPL 2021*, online.
16. On LTL model-checking for low-dimensional discrete linear dynamical systems. *MFCS 2020*, online.

## Publications in reverse chronological order[1]

1. Model checking linear temporal logic with standpoint modalities

   R. Aghamov, C. Baier, T. Karimov, R. Majumdar, J. Ouaknine, J. Piribauer, and T. Spork

   To appear in the proceeding of *22nd International Conference on Principles of Knowledge Representation and Reasoning (KR) 2025*

2. Multiple reachability in linear dynamical systems

   T. Karimov, E. Kelmendi, J. Ouaknine, and J. Worrell

   *ACM/IEEE Symposium on Logic in Computer Science (LICS) 2025*

3. *Verification of linear dynamical systems via o-minimality of the real numbers

   T. Karimov

   *EATCS International Colloquium on Automata, Languages, and Programming (ICALP) 2025*

4. On the decidability of Presburger arithmetic expanded with powers

   T. Karimov, F. Luca, J. Nieuwveld, J. Ouaknine, and J. Worrell

   *ACM-SIAM Symposium on Discrete Algorithms (SODA) 2025*

5. *The monadic theory of toric words

   V. Berthé, T. Karimov, J. Nieuwveld, J. Ouaknine, M. Vahanwala, and J. Worrell

   *Theoretical Computer Science, Vol. 1025*

6. *On the decidability of monadic second-order logic with arithmetic predicates

   V. Berthé, T. Karimov, J. Nieuwveld, J. Ouaknine, M. Vahanwala, and J. Worrell

   *ACM/IEEE Symposium on Logic in Computer Science (LICS) 2024*

   **Distinguished Paper Award**

[1] In theoretical computer science, the authors are usually listed in the alphabetical order. The papers in which Toghrul Karimov was the clear lead author, as well as the papers that are almost entirely based on his results from the dissertation, are marked with an asterisk.

7. *Linear dynamical systems with continuous weight functions
   R. Aghamov, C. Baier, T. Karimov, J. Piribauer, and J. Ouaknine
   *HSCC 2024*
   **ACM SIGBED Best Paper Award**

8. Model checking Markov chains as distribution transformers
   R. Aghamov, C. Baier, T. Karimov, J. Nieuwveld, J. Ouaknine and M. Vahanwala
   *Principles of Verification: Cycling the Probabilistic Landscape, LNCS 15261, 2024*

9. *The power of Positivity
   T. Karimov, E. Kelmendi, J. Nieuwveld, J. Ouaknine and J. Worrell
   *ACM/IEEE Symposium on Logic in Computer Science (LICS) 2023*

10. *What's decidable about discrete linear dynamical systems?
    T. Karimov, E. Kelmendi, J. Ouaknine and J. Worrell
    *Principles of System Design–Thomas A. Henzinger Festschrift, LNCS 13660, 2022*

11. Parameter synthesis for parametric probabilistic dynamical systems and prefix-independent specifications
    C. Baier, F. Funke, S. Jantsch, T. Karimov, E. Lefaucheux, J. Ouaknine, D. Purser, M. Whiteland, and J. Worrell
    *International Conference on Concurrency Theory (CONCUR) 2022*

12. *The pseudo-reachability problem for diagonalisable linear dynamical systems
    J. D'Costa, T. Karimov, R. Majumdar, J. Ouaknine, M. Salamati, and J. Worrell
    *International Symposium on Mathematical Foundations of Computer Science (MFCS) 2022*

13. *What's decidable about linear loops?
    T. Karimov, E. Lefaucheux, J. Ouaknine, D. Purser, J. Worrell, and M. Whiteland
    *POPL 2022, Proc. of the ACM on Programming Languages, Vol. 6*

14. The orbit problem for parametric linear dynamical systems
    C. Baier, F. Funke, S. Jantsch, T. Karimov, E. Lefaucheux, F. Luca, J. Ouaknine, D. Purser, M. Whiteland, and J. Worrell
    *International Conference on Concurrency Theory (CONCUR) 2021*

15. *The pseudo-Skolem problem is decidable

    J. D'Costa, T. Karimov, R. Majumdar, J. Ouaknine, M. Salamati, S. Soudjani, and J. Worrell

    *International Symposium on Mathematical Foundations of Computer Science (MFCS) 2021*

16. *Deciding $\omega$-regular properties on linear recurrence sequences

    S. Almagor, T. Karimov, E. Kelmendi, J. Ouaknine, and J. Worrell

    *POPL 2021, Proc. of the ACM on Programming Languages, Vol. 5*

17. Reachability in dynamical systems with rounding

    C. Baier, F. Funke, S. Jantsch, T. Karimov, E. Lefaucheux, J. Ouaknine, A. Pouly, D. Purser, and M. Whiteland

    *IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS) 2020*

18. *On LTL model-checking for low-dimensional discrete linear dynamical systems

    T. Karimov, J. Ouaknine, and J. Worrell

    *International Symposium on Mathematical Foundations of Computer Science (MFCS) 2020*