Nicolas Mazzocchi

PhD in Computer Science

Curriculum vitae – updated on December 12, 2024

Last name	Mazzocchi
First names	Nicolas Adrien
Citizenship	French / EU
Language	French (native), English (professional), Slovak (A1)
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Research Interests

About — Formal verification relies on mathematical models to express precisely and analyze exhaustively the behaviors of systems. I focus on specification models with a good tradeoff between the expressiveness of system behaviors and the decidability of algorithms that ensure safety and robustness.

Keywords — formal methods, model-checking, monitoring, logic, automata, games

Positions

7/2024 – now — **Researcher**, *Slovak University of Technology (STU)*, Slovak Republic
Fakulta Elektrotechniky a Informatiky (Faculty of Electronic and Computer Science)

1/2022 – 6/2024 — **Postdoc**, *Institute of Science and Technology Austria (ISTA)*, Austria
Team of T. A. Henzinger

12/2020 – 12/2021 — **Postdoc**, *IMDEA Software Institute*, Spain
Team of P. Ganty

Education

2016 – 2020 — **PhD in Computer Science**, *Université libre de Bruxelles (ULB)*, Belgium
F.R.S.-FNRS FRIA Doctoral Grant
- 1 week International Winter School, HUJI, 2017
- 2 weeks International Summer School, Marktoberdorf, 2017

2014 – 2016 — **Master in Computer Science**, *ENS Paris-Saclay (ENS Cachan)*, France
MPRI inter-institutional research-oriented master program
- 5 months at Université libre de Bruxelles, ERASMUS+ student mobility, 2016
- 3 months at RWTH Aachen University, ERASMUS+ student mobility, 2015

2011 – 2014 — **Bachelor in Computer Science**, *Aix-Marseille University (AMU)*, France
- 1 month at École des Mines d'Alès & Incubator Innov'up, AMU internship funds, 2014
- 1 month at Laboratoire d'Informatique et Systèmes (LIS), AMU internship funds, 2013

Main Collaborations

- ISTA Austria, team of T. A. Henzinger
- VUT Brno Czech Republic, team of O. Lengál
- UMONS Belgium, team of M. Randour
- Université de Franche-Comté France, team of I. Jecker
- University of Liverpool United Kingdom, team of P. Totzke
- IMDEA Software Institute Spain, team of P. Ganty
- University of Colorado Boulder USA, team of S. Sankaranarayanan
- Hebrew University of Jerusalem, team of O. Kupferman
- ULB Belgium, team of J.-F. Raskin and E. Filiot

Grants

2024 **VAIA**, *hosted by STU*, funded by the Slovak ministry of research and innovation
Project for **R3 Established Researcher** aiming at the creation of a new research team with a budget of 210212 euros. **Not granted due to lack of allocations.**

2024 **Staff mobility**, *hosted by VUT Brno*, funded by ERASMUS+
Collaboration with O. Lengál and Lukáš Holík.

2016 **FRIA**, *hosted by ULB*, funded by F.R.S.-FNRS
Doctoral grant of 4 years.

Responsibilities

4/2024 – now STU examination committee member for Bachelor and Engineering study programs

2023 Viennese workshop on Verification, main organizer (35 participants, 28 speakers)

9/2022 – 6/2024 Organization of the team seminars at ISTA

9/2022 – 6/2024 Co-organization of the inter-team (ISTA, TU Wien) seminars at ISTA

5/2021 – 9/2021 Co-organization of the inter-team seminars at IMDEA

2019 RP'19 conference assitant organizer (80 participants, 34 speakers)

1/2017 – 9/2020 Organization of the team seminars at ULB

1/2017 – 9/2020 SVN Administrator of the research team Modelization and Verification at ULB

Software

Lead developer

2024 **QuAK**, *developed with N. E. Saraç (ISTA), M. Chalupa (ISTA)*
Quantitative automata library for safety-liveness monitoring, checker, and synthesizer. Available on **Zenodo** and **GitHub**.

2022 **FORKLIFT**
Büchi automata Ramsey-based language inclusion checker with antichain heuristics. Available on **Zenodo** (peer-reviewed by the CAV'22 artifact committee) and **GitHub**.

Participating developer

2013 **Automata Learner**, *developed with M. Gybels (LIS)*
Probabilistic automata spectral learner with randomized singular value decomposition of Hankel matrix, evaluated on PAutomaC challenges.

2013 **Led's Chat**, *developed with M. Caralp (LIS)*
Pure parallel microcontrollers program. Parts of the MP2013 project (Marseille being the European Capital of Culture).

Teaching

Invited Lecturer (lecture only)

2024 **Initiation to verification**, *at STU*, Single lecture, 20-25 undergraduate students
Awareness of system failure and introduction to computer-aided verification.

Teaching Instructor (lectures and exercises)

2023 **Foundation of Model Checking**, *at ISTA*, Half-semester, 5 PhD students
New course introduced to ISTA graduate school.

Teaching Assistant (exercises only)

2017 – 2020 **Formal Verification**, *at ULB*, Full-semester, 20-25 graduated students
Preparation and teaching of practicals. Management and grading personalized group projects of 3,4 or 5 students.

2018 – 2019 **Embedded systems**, *at ULB*, Full-semester, 25-30 graduated students
Preparation and teaching of practicals on computers. Management and grading personalized group projects of 3,4 or 5 students.

2018 **Fundamental computer science**, *at ULB*, Full-semester, 60-70 undergrads
Managing and grading a C++ project on SAT solver (MiniSAT).

Mentoring

2024 – now **Supervisor**, *at STU*, Alexandra Reviláková
Preparation of the Master Thesis research subject and supervision.

2022 – now **Close collaboration**, *at ISTA*, N. Ege Saraç
Co-authors of 6 publications, daily meetings, frequent visits at ISTA and invitations at STU.

2022 **Co-supervisor**, *at ISTA*, Pavol Kebis, (with T. A. Henzinger)
Preparation of the research internship subject and supervision.

PhD Thesis

Title Contributions to formalisms for the specification and verification of quantitative properties

Supervisors E. Filiot (ULB) and J.-F. Raskin (ULB)

Jury E. Filiot (ULB), Thierry Massart (ULB), J.-F. Raskin (ULB), P.-A. Reynier (AMU), S. Sankaranarayanan (University Colorado Boulder USA)

Graduation October 9th, 2020

Publications (alphabetical ordering of authors)

Articles published in peer-review journals (4)

- I. Jecker, N. Mazzocchi and P. Wolf. Decomposing Permutation Automata. Accepted for publication in Journal of Computer and System Sciences (JCSS)
- T. A. Henzinger, N. Mazzocchi and N. E. Saraç. Safety and Liveness of Quantitative Properties and Automata. Accepted for publication in Theoretical Computer Science (TCS).
- E. Filiot, N. Mazzocchi and J.-F. Raskin. Pattern Logic for Automata with Outputs. In Journal of Foundations of Computer Science, year 2020, volume 31, pages 711–748.
- E. Filiot, N. Mazzocchi and J.-F. Raskin. Decidable Weighted Expressions with Presburger Combinators. In Journal of Computer and System Sciences (JCSS), year 2019, volume 106, pages 1–22.

Articles invited in conference proceedings (1)

- M. Chalupa, T. A. Henzinger, N. Mazzocchi, and N. E. Saraç. QuAK: Quantitative Automata Kit. In 12th International Symposium On Leveraging Applications of Formal Methods, Verification and Validation (ISOLA'24) proceedings, year 2024, Lecture Notes in Computer Science (LNCS) volume 15222, pages 3–20.

Articles published in conference proceedings (13)

- M. Chalupa, T. A. Henzinger, N. Mazzocchi, and N. E. Saraç. Automating the Analysis of Quantitative Automata with QuAK. submitted
- T. A. Henzinger, N. Mazzocchi and N. E. Saraç. Strategic Dominance: A New Preorder for Nondeterministic Processes. In 35th International Conference on Concurrency Theory (CONCUR'24) proceedings, year 2024, Leibniz International Proceedings in Informatics (LIPIcs) volume 311, pages 29:1–29:20
- U. Boker, T. A. Henzinger, N. Mazzocchi and N. E. Saraç. Safety and Liveness for Quantitative Automata. In 34th International Conference on Concurrency Theory (CONCUR'23) proceedings, year 2023, Leibniz International Proceedings in Informatics (LIPIcs) volume 279, page 17:1–17:18
- T. A. Henzinger, N. Mazzocchi and N. E. Saraç. Quantitative Safety and Liveness. In 26th International Conference on Foundations of Software Science and Computation Structures (FoSSaCS'23) proceedings, year 2023, Lecture Notes in Computer Science (LNCS) volume 13992, pages 349–370
- T. A. Henzinger, P. Kebis, N. Mazzocchi and N. E. Saraç. Regular Methods for Operator Precedence Languages. In 50th International Colloquium on Automata, Languages, and Programming (ICALP'23) proceedings, year 2023, Leibniz International Proceedings in Informatics (LIPIcs) volume 261, pages 129:1–129:20
- K. Doveri, P. Ganty and N. Mazzocchi. FORQ-based Language Inclusion Formal Testing. In 34th International Conference on Computer Aided Verification (CAV'22) proceedings, year 2022, Lecture Notes in Computer Science (LNCS) volume 13372, pages 109–129

- T. A. Henzinger, N. Mazzocchi and N. E. Saraç. Abstract Monitors for Quantitative Specifications. In 22nd International Conference on Runtime Verification (RV'22) proceedings, year 2022, Lecture Notes in Computer Science (LNCS) volume 13498, pages 200-220.
- I. Jecker, N. Mazzocchi and P. Wolf. Decomposing Permutation Automata. In 32nd International Conference on Concurrency Theory (CONCUR'21) proceedings, year 2021, Leibniz International Proceedings in Informatics (LIPIcs) volume 203, pages 18:1–18:19
- E. Filiot, N. Mazzocchi, J.-F. Raskin, S. Sankaranarayanan and A. Trivedi. Weighted Transducers for Robustness Verification. In 31st International Conference on Concurrency Theory (CONCUR'20) proceedings, year 2020, Leibniz International Proceedings in Informatics (LIPIcs) volume 171, pages 17:1–17:21
- I. Jecker, O. Kupferman and N. Mazzocchi. Unary Prime Languages. In 45th International Symposium on Mathematical Foundations of Computer Science (MFCS'20) proceedings, year 2020, Leibniz International Proceedings in Informatics (LIPIcs) volume 170, pages 51:1–51:12
- E. Filiot, S. Guha and N. Mazzocchi. Two-way Parikh Automata. In 39th IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS'19) proceedings, year 2019, Leibniz International Proceedings in Informatics (LIPIcs) volume 150, pages 40:1–40:14
- E. Filiot, N. Mazzocchi and J.-F. Raskin. Pattern Logic for Automata with Outputs. In 22nd International Conference on Developments in Language Theory (DLT'18) proceedings, year 2018, Lecture Notes in Computer Science (LNCS) volume 11088, pages 304–317
- E. Filiot, N. Mazzocchi and J.-F. Raskin. Decidable Weighted Expressions with Presburger Combinators. In 21st International Symposium on Fundamentals of Computation Theory (FCT'17) proceedings, year 2017, Lecture Notes in Computer Science (LNCS) volume 10472, pages 243–256

Scientific Communications

Invited Seminars (8)

- Université de Franche-Comté, France, 2024
- UMONS, Belgium, 2024
- VUT Brno, Czech Republic, 2024
- STU Bratislava, Slovak Republic, 2023
- University of Liverpool, United Kingdom, 2023
- ISTA and TU Wien, Austria, 2021
- Colorado Boulder University (online due to the pandemic), USA, 2020
- ISTA, Austria, 2018

Talks with scientific selection committee (15)

- M. Chalupa, T. A. Henzinger, N. Mazzocchi, and N. E. Saraç. Safety and Liveness but Quantitative. At 12th Highlights of Logic, Games, 2024, and Automata, Bordeaux, France.

- T. A. Henzinger, N. Mazzocchi and N. E. Saraç. Strategic Dominance: A New Preorder for Nondeterministic Processes. At 35th International Conference on Concurrency Theory (CONCUR'24), 2024, Calgary, Canada.
- U. Boker, T. A. Henzinger, N. Mazzocchi and N. E. Saraç. Safety and Liveness for Quantitative Automata. At 34th International Conference on Concurrency Theory (CONCUR'23), 2023, Antwerp, Belgium.
- T. A. Henzinger, P. Kebis, N. Mazzocchi and N. E. Saraç. Regular Methods for Operator Precedence Languages. At 50th International Colloquium on Automata, Languages, and Programming (ICALP'23), 2023, Paderborn, Germany.
- T. A. Henzinger, N. Mazzocchi and N. E. Saraç. Abstract Monitors for Quantitative Specifications. At 22nd International Conference on Runtime Verification (RV'22), 2022, Tbilisi, Georgia.
- I. Jecker, N. Mazzocchi and P. Wolf. Decomposing Permutation Automata. At 32nd International Conference on Concurrency Theory (CONCUR'21), 2021, Virtual Conference.
- E. Filiot, N. Mazzocchi, J.-F. Raskin, S. Sankaranarayanan and A. Trivedi. Weighted Transducers for Robustness Verification. At 31st International Conference on Concurrency Theory (CONCUR'20), 2020, Virtual Conference.
- E. Filiot, S. Guha and N. Mazzocchi. Two-way Parikh Automata. At 39th IARCS Annual Conference on Foundations of Software Technology and Theoretical Computer Science (FSTTCS'19), 2019, Bombay, India.
- E. Filiot, S. Guha and N. Mazzocchi. Two-way Parikh automata: tool in transducer theory. At 7th Highlights of Logic, Games, and Automata, 2019, Warsaw, Poland.
- E. Filiot, N. Mazzocchi and J.-F. Raskin. Pattern Logic for Automata with Outputs. At 6th Highlights of Logic, Games, and Automata, 2018, Berlin, Germany.
- E. Filiot, N. Mazzocchi and J.-F. Raskin. Pattern Logic for Automata with Outputs. At 22nd International Conference on Developments in Language Theory (DLT'18) 2018, Tokyo, Japan.
- E. Filiot, N. Mazzocchi and J.-F. Raskin. Decidable Weighted Expressions with Presburger Combinators. At 2nd Winter School in Engineering and Computer Science, 2017, Jerusalem, Israel.
- E. Filiot, N. Mazzocchi and J.-F. Raskin. Decidable Weighted Expressions with Presburger Combinators. At 5th Highlights of Logic, Games, and Automata, 2017, London, United Kingdom.
- E. Filiot, N. Mazzocchi and J.-F. Raskin. Decidable Weighted Expressions with Presburger Combinators. At 21st International Symposium on Fundamentals of Computation Theory (FCT'17) 2017, Bordeaux, France.

Referees

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