

# Mirco Giacobbe

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## Areas of Specialization

Formal Verification of Cyber-physical and Software Systems, Formal Methods for Safe Artificial Intelligence, Machine Learning for Systems Analysis.

## Education

- 2019 PhD in Computer Science, Institute of Science and Technology Austria (ISTA)
- 2012 MSc in Embedded Systems, University of Trento
- 2012 MSc in Software Systems Engineering, RWTH Aachen University
- 2010 BSc in Computer Science, University of Trento

## Experience

- Sep 2021-current Assistant Professor, School of Computer Science, University of Birmingham.
- Oct 2019-Aug 2021 Research Associate, Department of Computer Science, University of Oxford.  
Supervisors: Alessandro Abate and Daniel Kroening.
- Sep 2013-Sep 2019 PhD student, Henzinger Group, ISTA.  
Supervisor: Tom Henzinger.
- Feb 2013-Aug 2013 Research Assistant, Embedded Systems Unit, FBK.  
Supervisor: Alessandro Cimatti.

## Honors & Awards

- 2015 Best Paper Award, ETAPS EASST
- 2013 Merit Award, University of Trento
- 2012 MSc with Distinction, University of Trento
- 2011-2012 Erasmus Mundus Scholarship, European Master in Informatics

## Software

FOSSIL: a neuro-symbolic synthesiser for Lyapunov functions and barrier certificates.  
NUXMV: a symbolic model checker for finite- and infinite-state models.

ARCADE.PLC: a verification platform for programmable logic controllers.

## Publications

### REFEREED CONFERENCE PAPERS

- [c1] Alessandro Abate, Daniele Ahmed, Alec Edwards, Mirco Giacobbe, and Andrea Peruffo. “FOSSIL: A Software Tool for the Formal Synthesis of Lyapunov Functions and Barrier Certificates Using Neural Networks”. In: *HSCC*. ACM, 2021, 24:1–24:11.
- [c2] Alessandro Abate, Mirco Giacobbe, and Diptarko Roy. “Learning Probabilistic Termination Proofs”. In: *CAV (2)*. Vol. 12760. Lecture Notes in Computer Science. Springer, 2021, pp. 3–26.
- [c3] Edoardo Bacci, Mirco Giacobbe, and David Parker. “Verifying Reinforcement Learning up to Infinity”. In: *IJCAI*. ijcai.org, 2021, pp. 2154–2160.
- [c4] Mirco Giacobbe, Mohammadhosein Hasanbeig, Daniel Kroening, and Hjalmar Wijk. “Shielding Atari Games with Bounded Prescience”. In: *AAMAS*. ACM, 2021, pp. 1507–1509.
- [c5] Mirco Giacobbe, Thomas A. Henzinger, and Mathias Lechner. “How Many Bits Does it Take to Quantize Your Neural Network?” In: *TACAS (2)*. Vol. 12079. Lecture Notes in Computer Science. Springer, 2020, pp. 79–97.
- [c6] Goran Frehse, Mirco Giacobbe, and Thomas A. Henzinger. “Space-Time Interpolants”. In: *CAV (1)*. Vol. 10981. Lecture Notes in Computer Science. Springer, 2018, pp. 468–486.
- [c7] Sergiy Bogomolov, Goran Frehse, Mirco Giacobbe, and Thomas A. Henzinger. “Counterexample-Guided Refinement of Template Polyhedra”. In: *TACAS (1)*. Vol. 10205. Lecture Notes in Computer Science. 2017, pp. 589–606.
- [c8] Sergiy Bogomolov, Mirco Giacobbe, Thomas A. Henzinger, and Hui Kong. “Conic Abstractions for Hybrid Systems”. In: *FORMATS*. Vol. 10419. Lecture Notes in Computer Science. Springer, 2017, pp. 116–132.
- [c9] Mirco Giacobbe, Calin C. Guet, Ashutosh Gupta, Thomas A. Henzinger, Tiago Paixão, and Tatjana Petrov. “Model Checking Gene Regulatory Networks”. In: *TACAS*. Vol. 9035. Lecture Notes in Computer Science. Springer, 2015, pp. 469–483. ETAPS EASST Best Paper Award.
- [c10] Sebastian Biallas, Mirco Giacobbe, and Stefan Kowalewski. “Predicate Abstraction for Programmable Logic Controllers”. In: *FMICS*. Vol. 8187. Lecture Notes in Computer Science. Springer, 2013, pp. 123–138.

### REFEREED JOURNAL PAPERS

- [j1] Alessandro Abate, Daniele Ahmed, Mirco Giacobbe, and Andrea Peruffo. “Formal Synthesis of Lyapunov Neural Networks”. In: *IEEE Control. Syst. Lett.* 5.3 (2021), pp. 773–778.
- [j2] Yulong Gao, Alessandro Abate, Frank J. Jiang, Mirco Giacobbe, Lihua Xie, and Karl Henrik Johansson. “Temporal Logic Trees for Model Checking and Control Synthesis of Uncertain Discrete-time Systems”. In: *IEEE Trans. Autom. Control.* (2021).

## INVITED JOURNAL PAPERS

- [j3] Rajeev Alur, Mirco Giacobbe, Thomas A. Henzinger, Kim G. Larsen, and Marius Mikućionis. “Continuous-Time Models for System Design and Analysis”. In: *Computing and Software Science*. Vol. 10000. Lecture Notes in Computer Science. Springer, 2019, pp. 452–477.
- [j4] Mirco Giacobbe, Calin C. Guet, Ashutosh Gupta, Thomas A. Henzinger, Tiago Paixão, and Tatjana Petrov. “Model checking the evolution of gene regulatory networks”. In: *Acta Inf.* 54.8 (2017), pp. 765–787.

## Invited Seminars

- May 2022 *On the Formal Verification of Deep Learning Systems, up to Infinity*, TU Delft
- Feb 2022 VAS Seminar, *Verifying Reinforcement Learning up to Infinity*, Imperial College London
- Dec 2021 *Towards Verified Reinforcement Learning*, University of Verona
- Dec 2021 ES Seminar, Solving Verification Questions Using Machine Learning, FBK, Trento
- Oct 2021 Digital Futures Lecture, Solving Verification Questions Using Machine Learning, KTH
- Jun 2021 GOALS Meeting, Infinite-time Safety Verification, University of Oxford
- Jun 2021 DEWS Seminar, Neuro-symbolic Liveness Verification, University of L’Aquila
- May 2021 MOVES Seminar, Neural Termination Analysis, RWTH Aachen
- May 2021 CPS Seminar, Infinite-time Verification of Cyber-physical Systems, Southampton
- Feb 2019 Seminar, Refining Template-polyhedra from Counter-examples, LIX, École Polytechnique
- Dec 2018 Verification Seminar, Verifying Hybrid Automata using CEGAR, University of Oxford
- Dec 2017 Verimag Seminar, Counterexample-guided Refinement of Template Polyhedra, Grenoble
- Dec 2016 Dagstuhl Seminar, Counterexample-guided Refinement of Template Polyhedra, Dagstuhl
- Apr 2015 ES Seminar, Model-checking Gene Regulatory Networks, FBK, Trento

## Professional Service

### CONFERENCE ORGANIZATION

- 2022 Co-organiser (jointly with Guy Avni, Anna Lukina, and Christian Schilling), Workshop on Open Problems in Learning and Verification of Neural Networks (WOLVERINE), Haifa?
- 2021 Co-organiser (jointly with Guy Avni, Anna Lukina, and Christian Schilling), Workshop on Open Problems in Learning and Verification of Neural Networks (WOLVERINE), Online
- 2016 Registration & travel grants officer, CPSWeek, Vienna

### PROGRAM COMMITTEES

- 2022 International Joint Conference on Artificial Intelligence (IJCAI)
- 2022 Conference on Formal Modeling and Analysis of Real Time Systems (FORMATS)
- 2021 Repeatability Evaluation of Conference on Quantitative Evaluation of Systems (QEST)
- 2021 Workshop on Numerical Software Verification (NSV)
- 2017 Repeatability Evaluation of Conf. on Hybrid Systems: Computation and Control (HSCC)
- 2016 Workshop on Numerical Software Verification (NSV)

## TEACHING

- Spring 2021 Lecturer, Data Structures & Databases, University of Birmingham  
Fall 2021 Lecturer, Systems Programming, University of Birmingham  
Fall 2020 Tutor, Probabilistic Model Checking, University of Oxford  
Spring 2015 Teaching Assistant, Advanced Topics in Formal Methods, ISTA

## ADVISING

BSc project supervisor at the University of Birmingham for David Butler (2021), Omar Lamrani (2021), Joseph Tebbett (2021), Xuanwei Xu (2021)

BSc project inspector at the University of Birmingham for Owain Edwards (2021), Greta Kabanovaite (2021), Keerthi Rachamalla (2021)

MSc project co-supervisor at the University of Oxford for Diptako Roy (jointly with Alessandro Abate, *Counterexample-guided Inductive Synthesis of Ranking Supermartingales*, 2020), Hjalmar Wijk (jointly with Daniel Kroening, *Deep RL Does Not Learn to be Safe*, 2020)

## ADMINISTRATION

- 2015-2018 Treasurer, Graduate School Association, ISTA

## PARTICIPATION IN RESEARCH PROJECTS

- 2019-2021 Research Associate, *High-Integrity, Complex, Large, Software and Electronic Systems* (HI-CLASS), funded by Innovate UK.

## REVIEW ACTIVITY

International Joint Conference on Artificial Intelligence (IJCAI) 2022; Conference on Decision and Control (CDC) 2020; Conference on Hybrid Systems: Computation and Control (HSCC) 2020, 2021; Conference on Formal Modelling and Analysis of Timed Systems (FORMATS) 2017; Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS) 2016, 2017, 2020; Conference on Cyber-Physical Systems, Networks, and Applications (CPSNA) 2016; Conference of Computational Methods for Systems Biology (CMSB) 2015; Conference on Computer-Aided Verification (CAV) 2015, 2021; European Conference on Artificial Intelligence (ECAI) 2020; Information and Computation (Journal) 2019, 2021; Workshop on Numerical Software Verification (NSV) 2015; Workshop on Quantitative Aspects of Programming Languages and Systems (QAPL) 2015;

## ADMINISTRATIVE SERVICE

MSc admissions, University of Birmingham, 2022; PhD pre-screening, IST Austria, 2018