

Luca Di Stefano

Curriculum vitae
July 2024

Personal information

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Research interests

My research mainly concerns the formal modelling and analysis of agent-based models of complex collective systems. On one hand, this entails the development of formally defined high-level languages to concisely describe the features of individual agents; on the other hand, it requires applying and improving state-of-the-art verification techniques to check the collective behaviour of the resulting system.

Keywords associated with my interests include:

Modelling: Agent-based modelling, Attribute-based communication, Collective adaptive systems, Domain-specific languages, Multi-agent systems, Process algebras, Stigmergic interaction, Structural operational semantics, Temporal logics.

Analysis: Bounded model checking, Explicit-state and symbolic model checking, Software verification, Static analysis.

Education

Gran Sasso Science Institute

L'Aquila, Italy

PhD in Computer Science

November 2016 – October 2020

Thesis: *Modelling and Verification of Multi-Agent Systems via Sequential Emulation*

Advisors: Rocco De Nicola, Omar Inverso

URL: hdl.handle.net/20.500.12571/10181

Other activities: Student representative in the academic senate (2018–2020).

University of L'Aquila

L'Aquila, Italy

MSc in Computer Science and Systems Engineering

March 2014 – October 2016

Thesis: *Design of a reactive system for autonomous UAV navigation in unknown environments.*
Thesis written in Italian. Original title: *Progettazione di un sistema reattivo per la navigazione autonoma di un drone in ambienti sconosciuti.*

Advisors: Eliseo Clementini, Enrico Stagnini

Final grade: 110/110, *cum laude*

Official degree name: *Ingegneria Informatica e Automatica.*

Academic Career

TU Wien

Vienna, Austria

University assistant (Post-doc)

March 2024 – Present time

Member of the Cyber-Physical Systems research unit.

Web page of the unit: <https://informatics.tuwien.ac.at/orgs/e191-01>

University of Gothenburg/Chalmers

Gothenburg, Sweden

Post-doctoral researcher

May 2022 – February 2024

Member of the d-SynMA ERC Consolidator project (Distributed Synthesis from Single to Multiple Agents). The main aim of the project is to develop the theoretical foundations that will enable reactive synthesis in the context of multiple agents.

Web page of the project: <https://dsynma.bitbucket.io>

CONVECS, Inria/LIG

Grenoble, France

Post-doctoral researcher

November 2020 – April 2022

I developed an automated translation from state-based temporal properties into MCL (an extension of the alternation-free fragment of the modal μ -calculus), and used it in combination with compositional techniques to verify collective adaptive systems.

SySMA, IMT Lucca

Lucca, Italy

Grant holder

December 2019 – October 2020

The grant topic was “Verification of Emerging Properties in Collective Adaptive Systems”. I adapted a structural encoding procedure I had been working upon as part of my PhD to multiple verification tools implementing a variety of techniques, including predicate abstraction, k -induction, and property-directed reachability.

CONVECS, Inria/LIG

Grenoble, France

Visiting PhD student

March – July 2019

As a visitor at CONVECS, I focussed on topics related to my doctoral thesis, such as defining a structural encoding of multi-agent systems in the LNT specification language and using it to verify these systems through model checking.

Teaching

TU Wien

Vienna, Austria

MSc course in GPU Architectures and Computing

April – July 2024

Teaching assistant (approx. 30 hours). The course aimed at understanding GPU computer architectures, becoming familiar with GPU programming models and environments, and solving problems through GPU programming (CUDA). I assisted in supervision and grading of group assignments related to the course.

University of Gothenburg and Chalmers

Gothenburg, Sweden

BSc course in Principle of Concurrent Programming

August – October 2023

January – March 2023

Teaching assistant (approx. 80 hours). The course covered both shared-memory and message-passing concurrency, using Java and Erlang as reference languages. I provided assistance in lab sessions, grading of assignments and exams, and Erlang coding tutorials.

Polytech Paris-Saclay
MSc course in Modelling and Verification

Paris, France
March – April 2022
April – May 2021

36-hour course for Master students in Computer Science Engineering, *filière apprentissage*. Held remotely (2021) and in person (2022) as a supply teacher (*intervenant vacataire*). The course focused on the following topics: modelling of concurrent systems through communicating automata (labelled transition systems); behavioural equivalences; process algebras (CCS, LNT); modal and temporal logics (HML, μ -calculus, MCL); model checking; modelling of real-time systems through timed automata; model-based testing. Tools such as CADP and UPPAAL were showcased in lab sessions.

Supervised Master’s students.....

Love Lyckaro. 2023. *Evaluating In-Memory Caching Strategies for Distributed Web Services*. Gothenburg, Sweden: Chalmers University of Technology.

Other academic activities

Reviewing activity.....

Conferences: SEFM 2019, TASE 2019, AAMAS 2021, FM 2021, ICSoft 2021, ISoLA 2021, FORTE 2022, ISoLA 2022, CSL 2023, iFM 2023, TACAS 2023, EMSOFT 2024, FMICS 2024, iFM 2024, ISoLA 2024.

Artifact evaluations: COORDINATION 2023.

Journals: Logical Methods in Computer Science (2023), Science of Computer Programming (2022, 2024), Software Tools for Technology Transfer (2023).

Program Committees.....

FMICS 2024.

Workshop Chair.....

FTfJP 2024 (planned).

Participation to PhD schools.....

1st VMCAI Winter School **Lisbon, Portugal**

Attendee *January 2019*

The school featured lectures on several topics associated with the VMCAI conference series, including: abstract interpretation (Patrick Cousot, New York University); computing with SAT oracles (João Marques-Silva, University of Lisbon); neural network verification (M. Pawan Kumar, University of Oxford); verification of distributed protocols (Ken McMillan, Microsoft Research).

Invited presentations.....

○ *Compositional Verification of Stigmergic Collective Systems*. Invited presentation to the CONVECS research team (Inria/LIG). Grenoble, France, 16 May 2023.

○ *Verifying collective adaptive systems by emulation*. Remote presentation to the Formal Methods unit of the Computer Science and Engineering department (University of Gothenburg and Chalmers). Gothenburg, Sweden, 10 March 2022.

- *Multi-agent (smart) systems with virtual stigmergies*. Kickoff meeting of Italian national research project (PRIN) *IT MATTERS: Methods and Tools for Trustworthy Smart Systems*. Pisa, Italy, 14 October 2019.
- *Multi-agent systems with virtual stigmergies*. Invited presentation at IMT School for Advanced Studies. Lucca, Italy, 3 July 2018.

Skills

Technical skills: My experience in programming spans more than a decade. As of now my languages of choice are mainly F# and Python, but I have worked with a number of popular languages across the years (e.g., C, C++, C#, Erlang, Go, Java, Prolog). I am familiar with software verification tools (CBMC, ESBMC, Infer), model checking software (CADP, NuXmv, SPIN), and SAT/SMT solvers (Glucose, MathSat, Minisat, Z3). I have some knowledge of control theory, computer architectures, assembly languages, and hardware description languages (mainly VHDL). I am also familiar with version control systems such as Git and Subversion.

Language skills: Italian is my first language. I am fluent in English (CEFR level C1–C2) and have some knowledge of French (CEFR level A2–B1). I have basic Swedish skills (CEFR level A1).

Publications

Journal articles.....

- L. Di Stefano and F. Lang. 2024. “Compositional Verification of Priority Systems Using Sharp Bisimulation”. In: *Formal Methods in Syst. Des.* 62.
- Y. Abd Alrahman, S. Azzopardi, L. Di Stefano, and N. Piterman. 2023. “Language Support for Verifying Reconfigurable Interacting Systems”. In: *STTT* 25.
- R. De Nicola, L. Di Stefano, O. Inverso, and S. Valiani. 2023. “Modelling Flocks of Birds and Colonies of Ants from the Bottom Up”. In: *STTT* 25.
- R. De Nicola, L. Di Stefano, O. Inverso, and A. Uwimbabazi. 2022. “Automated Replication of Tuple Spaces via Static Analysis”. In: *Sci. Comput. Program.* 223.
- L. Di Stefano, R. De Nicola, and O. Inverso. 2022. “Verification of Distributed Systems via Sequential Emulation”. In: *TOSEM* 31.
- R. De Nicola, L. Di Stefano, and O. Inverso. 2020. “Multi-Agent Systems with Virtual Stigmergy”. In: *Sci. Comput. Program.* 187.
- R. De Nicola, L. Di Stefano, and O. Inverso. 2018. “Toward Formal Models and Languages for Verifiable Multi-Robot Systems”. In: *Frontiers Robotics AI* 5.

Peer-reviewed conference and workshop papers.....

- R. De Nicola, L. Di Stefano, O. Inverso, and S. Valiani. 2023-09-13/2023-09-15. “Intuitive Modelling and Formal Analysis of Collective Behaviour in Foraging Ants”. In: *21st International Conference on Computational Methods in Systems Biology (CMSB)*. Vol. 14137. LNCS. Springer, pp. 44–61.

- Y. Abd Alrahman, S. Azzopardi, L. Di Stefano, and N. Piterman. 2024. “Attributed Point-to-Point Communication in R-CHECK”. In: *12th International Symposium on Leveraging Applications of Formal Methods, Verification and Validation (ISoLA)*. To appear.
- L. Di Stefano and O. Inverso. 2024. “Emerging Synchrony in Applauding Audiences: Formal Analysis and Specification”. In: *12th International Symposium on Leveraging Applications of Formal Methods, Verification and Validation (ISoLA)*. To appear.
- L. Di Stefano and F. Lang. 2023. “Compositional Verification of Stigmergic Collective Systems”. In: *24th International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI)*.
- R. De Nicola, L. Di Stefano, O. Inverso, and S. Valiani. 2022. “Modelling Flocks of Birds from the Bottom Up”. In: *11th International Symposium on Leveraging Applications of Formal Methods, Verification and Validation (ISoLA)*.
- L. Di Stefano and F. Lang. 2021. “Verifying Temporal Properties of Stigmergic Collective Systems Using CADP”. In: *10th International Symposium On Leveraging Applications of Formal Methods, Verification and Validation (ISoLA)*.
- L. Di Stefano, F. Lang, and W. Serwe. 2020. “Combining SLiVER with CADP to Analyze Multi-agent Systems”. In: *22nd International Conference on Coordination Models and Languages (COORDINATION)*.
- R. De Nicola, L. Di Stefano, and O. Inverso. 2018. “Multi-Agent Systems with Virtual Stigmergy”. In: *STAF Collocated Workshops, Revised Selected Papers*.

Book chapters.....

- R. De Nicola, L. Di Stefano, O. Inverso, and S. Valiani. 2022. “Process Algebras and Flocks of Birds”. In: *A Journey from Process Algebra via Timed Automata to Model Learning - Essays Dedicated to Frits Vaandrager on the Occasion of His 60th Birthday*.

Preprints and technical reports.....

- L. Di Stefano and F. Lang. *Compositional Verification of Priority Systems using Sharp Bisimulation*. Tech. rep. INRIA. URL: <https://hal.inria.fr/hal-03640683>.
- S. Azzopardi, N. Piterman, G. Schneider, and L. Di Stefano. 2023. *LTL Synthesis on Infinite-State Arenas defined by Programs*. arXiv: 2307.09776 [cs.LO].
- Love Lyckaro. 2023. *Evaluating In-Memory Caching Strategies for Distributed Web Services*. Gothenburg, Sweden: Chalmers University of Technology.

Citation metrics.....

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